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[Continued from SUPPLEMENT No. 131.]

THE CAÑONS OF THE COLORADO.

[Compiled from the report of Prof. J. W. Powell, Geologist, in charge U. S. Geological and Geographical survey of the Territories.]

No. V.

THOUGH in general this whole great region is an arid land of naked, barren rock, yet here and there can be found scanty forests and good grazing lands, but very rarely arable land. The low ridges running out from the base of the Vermilion Cliffs are usually covered by a scanty growth of cedars, fit only for fencing or firewood. About one-fourth the area of the plateaus above, on the Vermilion and White Cliffs, is covered by scattered pines and cedars, but they are of little value and scarcely accessible. The ridges running out from the foot of the eastern face of the Pauns-á-gunt Plateau are mostly covered by low, scrubby cedars; but in the intervening valleys are groves of pine which could afford considerable lumber, and on the plateau itself is the finest forest of pine and spruce in southern Utah. It is easily accessible from the valley of the Sevier River on the west, and when the country becomes settled will be quite valuable.

The *mesas* in the basin of the Paria River are mostly covered by cedars and piñon pines. Where the cañons of the streams widen into valleys, small groves of cottonwoods are common, and near the sources of these streams are scattered pitch-pines, birch thickets, and low, scrubby oaks. The eastern end of the Kai-pár-o-wits Plateau is covered by a forest of pine and cedar. No timber of any value is found in the Escalante Basin. The summit of the Aquarius Plateau is crowned by a forest of spruce, while aspens and birches fringe its lakes and streams. Further down, pines grow in open groves, and these continue till near the level of the Escalante Basin, where they give way to cedars.

Upon the foot-hills of the Henry Mountains is a dense growth of low, scrubby cedars, and in the gulches near their summits are a few groves of aspen, pine and spruce. In the cañon of the Dirty Devil River, and in other cañons drained by the Colorado, are considerable quantities of cottonwood. Of the region from Kanab to the Dirty Devil, probably ten per cent. is covered by forests valuable for lumber; thirty per cent. by forests valuable for fencing and fuel; and the remainder by grass, sage, greasewood, loose sands, or naked rock.

FIG. 39.—ELFIN WATER POCKET.

As irrigation is necessary to successful cultivation in all the region previously referred to, the amount of arable land depends solely upon the water supply. Here and there a spring may burst out from a cliff and furnish sufficient water to irrigate from a hundred to a hundred and fifty acres. Pleasant Creek could irrigate about a thousand acres contiguous that would serve for cultivation. There is a settlement in the Paria Valley where the river is utilized for irrigation, but much difficulty is experienced from the fact that the waters are so highly charged with clay that they soon form an impervious coat over the soil, that prevents the water from sinking in. The lower end of Potato Valley, about five thousand feet above the sea, contains about two thousand acres of arable land, and a creek with sufficient water to irrigate it.

Over all the country between the Pauns-á-gunt Plateau and the White Cliffs grass grows abundantly and there are many fine springs. In the Paria Basin, also, is considerable grazing land, and east of the Henry Mountains is some land that, though unfit for cultivation, is good for cattle. The eastern slope of the Aquarius Plateau has an average elevation of 7,000 feet above the sea, and, though too high for cultivation, affords the finest natural facilities for grazing. Grass is everywhere abundant, and streams of pure water are met at intervals of every two or three miles. Though but about one per cent. of the land between the Kanab and the Dirty Devil is fit for cultivation, probably sixty per cent. is more or less valuable for grazing.

Barren as the country is, there are some Indians. These are perhaps in the most primitive state of any others on the continent. During the greater part of the year the climate is warm and dry, and they have no shelter. They clear a small circular space of ground and bank it about with brush and sand. Here they wallow during the day, and sleep at night in a promiscuous heap of men, women and children. They wear very little clothing. They live alone, cut off from all the world. They receive nothing from the government, and, being too poor to tempt the trader, and their country almost inaccessible, the white man never visits them. The mountain sides are covered with wild fruits, nuts and native grains, upon which they subsist. They eat the *cose*, the fruit of the yucca or Spanish bayonet. They gather the luscious fruit of a cactus plant, and eat them as grapes, or express the juice, making the dry pulp into cakes for winter, and drinking the wine about the camp fires at night, making the wilderness merry with their revelries. They gather the seeds of golden rods, sunflowers, grasses, and other plants. These they roast in a singular manner. They place the seeds with red hot coals in a willow tray, and by rapid and dexterous shaking and tossing keep the coals aglow and the seeds and tray from burning. Then they grind the seeds into a fine flour, and make them into cakes and mush. For a mill they use a large flat rock lying upon the ground, and a cylindrical stone in their hands. They fill their laps with the seeds, making a hopper to the mill with their dusky legs, and grind by pushing the seeds across the rock to one edge, where the flour falls into a tray. A group of women will grind together, keeping time to a chant, or gossiping and chatting, while the young girls jest and chatter merrily.

There is little game in the country, and the Indians are not supplied with guns, yet now and then they shoot a mountain sheep or a deer with their arrows. They get many rabbits, sometimes with arrows, sometimes with nets. They make a net, sometimes a hundred yards long, of the fibers of a native flax, and place it in a semicircle, with wings of sage brush. Then they have a circle hunt, and drive great numbers of rabbits into the inclosure, where they are shot with arrows. Most of the bows are of cedar, but the best are made of horn. The horns of mountain sheep are soaked in water till quite soft, then cut into thin strips and glued together. In the autumn grasshoppers are abundant. When cold weather sets in these insects are benumbed and may be gathered by the bushel. At such time the Indians dig a hole, place a layer of hot stones in the bottom, then a layer of grasshoppers, another layer of heated stones, next grasshoppers, and so on alternately till the hole is filled. The insects are thus roasted, and when cool are taken out, thoroughly dried, and ground into meal. Grasshopper gruel or grasshopper cake is a great treat for these people.

The country has some archæological interest. In one of the Cañons the ruins of an old building were found by the explorers. There is a narrow plain between the river and the left wall of the cañon, and here, on the brink of a rock two hundred feet high, stands this old house. Its walls are of stones laid in mortar with much regularity. Probably it was once three stories high; the first of which is still almost intact, the second much broken down, and of the third scarcely any trace remains. Quantities of flint chips, arrow heads, and fragments of pottery are scattered

FIG. 36.—TOWER AT THE MOUTH OF THE DIRTY DEVIL RIVER.

FIG. 37.—TEMPLES OF ROCK ROVERS' LAND.

THE CAÑONS OF THE COLORADO.

Fig. 45.—MARBLE CAÑON.

Fig. 42.—CLIMBING THE GRAND CAÑON.

Fig. 46.—SIDE CAÑON.

Fig. 47.—THE HEART OF CATARACT CAÑON.

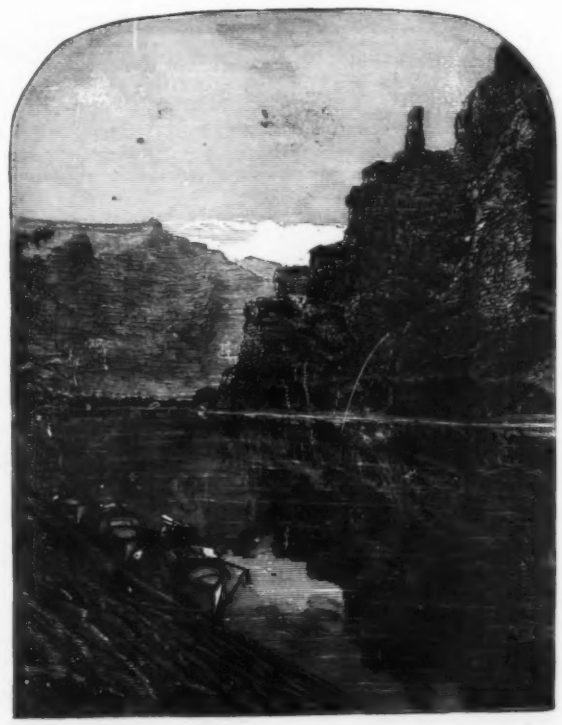


Fig. 48.—LIGHTHOUSE ROCK, CAÑON OF DESOLATION

THE CAÑONS OF THE COLORADO.

FIG. 40.—PILLING'S CASCADE, THE LOWER FALL ON PINE CREEK.

FIG. 38.—CAVE LAKE IN KANAB CAÑON

FIG. 41.—MARY'S VAIL, THE UPPER FALL ON PINE CREEK.

about. On the face of the cliff beneath the house, and down the river for two or three hundred yards, are many etchings. Fifteen miles below on the river are other buildings. The principal ruin is on a hill, and a part of the walls yet stands. The house was in the shape of an L, with five rooms on the ground floor, one in the angle, and two in each wing. In the angle there is a deep excavation. From what we know of the people in the province of Tusayan, northern Arizona, who doubtless are of the same race as the former inhabitants of these ruins, we conclude that this underground chamber was a "kiva," where their religious ceremonies were performed. Professor Powell, in attempting to climb a neighboring rounded eminence upon the top of the cañon wall, was surprised to find a stairway cut in the rocks, and where the rock became vertical he discovered a rickety old ladder. This eminence must have been used as a watch-tower by that ancient people. At one point in the Grand Cañon are the ruins of an old house and evidence of a garden where a great spring bursts from the rock. On rocks near by are curious etchings.

Near the junction of the Bright Angel River with the Colorado were discovered the foundations of two other old houses, and in one room a mealing stone, deeply worn. A great quantity of broken pottery was strewn about, and old trails were traced worn deep into the rock. It is a source of wonder why this ancient people sought such inaccessible places for their homes. Doubtless they were an agricultural race, but there is little land here that could be cultivated. To the west of Oraiby, one of the towns in northern Arizona, the inhabitants have built little terraces along the face of the cliff where a spring flows forth, and thus make their garden sites. It is possible that the ancient inhabitants of these places made their agricultural lands in the same way. But why should they choose such barren spots? Surely the country was not so densely populated as to demand the utilization of such an arid land. The only apparent solution is that the ancient people fled to these fastnesses to escape the persecutions of the Spaniards. For a century or two after the settlement of Mexico by the Spanish many expeditions were sent into the region now known as Arizona and New Mexico to bring the town-building race under the dominion of Spain. Many of their villages were destroyed, and the inhabitants fled to regions then unknown. According to the traditions among the people who inhabit the *pueblos* that still remain, these unknown regions were the cañons of the Colorado. These cañon ruins have a much more modern appearance than those scattered over Nevada, Utah, Colorado, and New Mexico. The old Spanish conquerors had a monstrous greed for gold and a wonderful lust for saving souls, and when they could not plunder they converted the heathen by the argument of the sword. It is no wonder that the ancient inhabitants fled to the cañons. On many of the tributaries of the Colorado their deserted dwellings have been found. Those that show evidences of having been built during the latter part of their occupation of the country are usually placed on the most inaccessible cliffs. The mouths of caves were walled across, and there are other evidences of their anxiety to secure defensible positions. Probably the nomadic tribes were sweeping down upon them, and hence these unusual safeguards. So from remotest time the struggle for existence among men has been as fierce as that between the brutes.

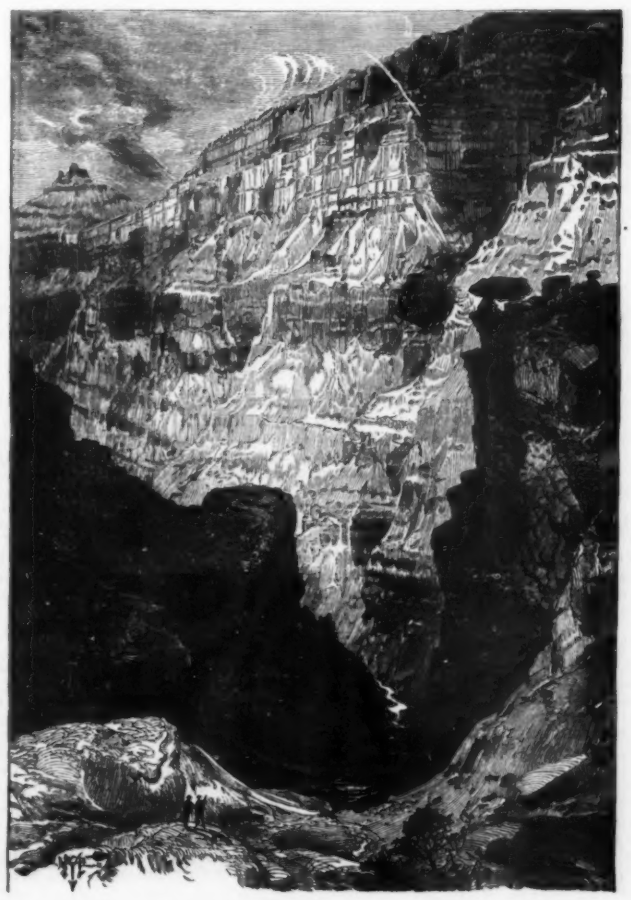


FIG. 43.—MU-AV CAÑON, A SIDE GORGE.

FIG. 44.—GRANITE WALLS, GRAND CAÑON.

THE CAÑONS OF THE COLORADO.

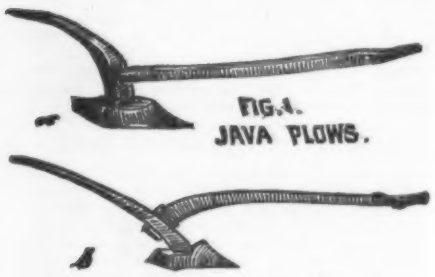


FIG. 1.—PLOWS FROM JAVA.

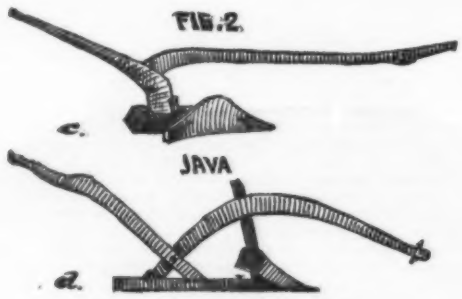


FIG. 2.—JAVANESE PLOWS.

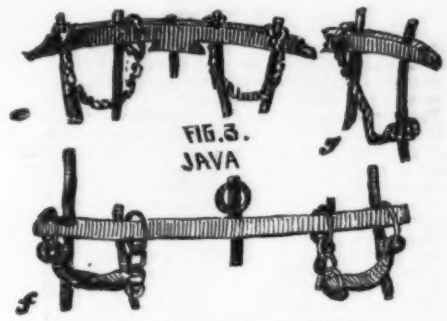


FIG. 3.—JAVANESE OX-YOKES.

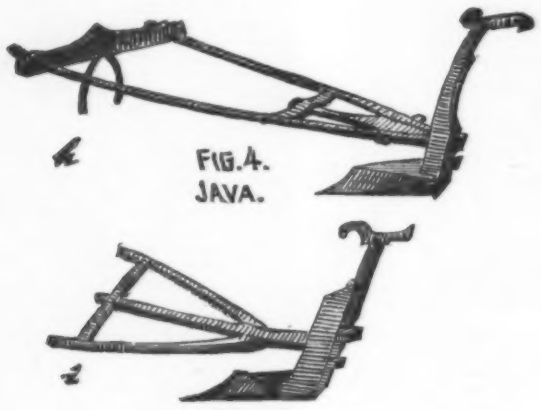


FIG. 4.

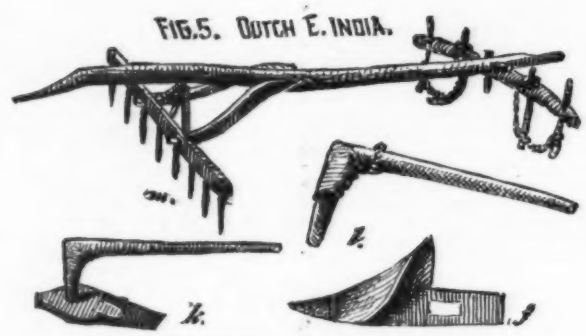


FIG. 5.—IMPLEMENTS OF DUTCH EAST INDIA.

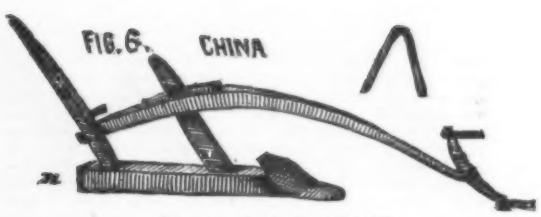


FIG. 6.—CHINESE PLOW.

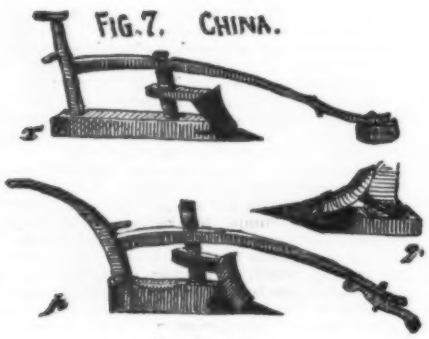


FIG. 7.

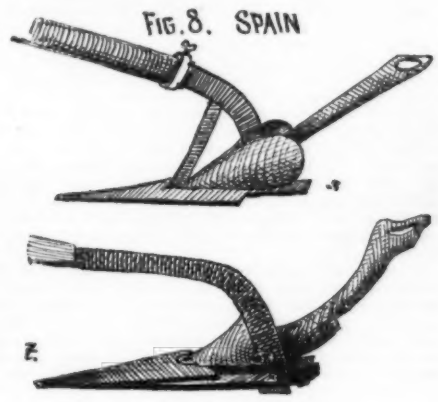


FIG. 8.—SPANISH PLOW.

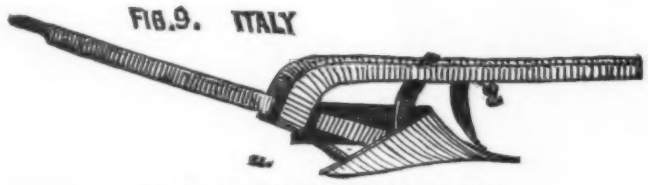


FIG. 9.—PLOW OF CREMONA, ITALY.

PLOWS AT THE PARIS EXHIBITION.

PLOWS AT THE PARIS EXHIBITION.

WHILE the great Exhibitions furnish the means of studying the latest developments and improvements in machinery and manufactures and the latest novelties in art, whether of the chisel, brush, or needle, they also enable the student to see the various steps by which man has arrived at his present eminence.

Great attention has been paid of late years to the history of the race—or, as some prefer it, the races—of men. The ethnologist takes it up from such standpoint as he may prefer, and may devote himself to the lingual, may consider the various languages, their roots and affinities; or he takes politics, and considers man in his primitive, family, tribal, or national relation; or religion, and he notices the growth and development of the principle of veneration, the superstitions, the concretion of ideas into systems, with their special functionaries and priests set apart for the proper ordering of the services and the offering of the oblations to win the favor or deprecate the anger of the Deity; a fourth may take physiology, or a section of it—craniology—and can read a series of lessons from a row of skulls which suggests little but vague generalities to most of us. Hamlet did not know Yorick's skull by his bumps, but the gravedigger knew whose brain-pan he had thrown out in making room for the body of the fair Ophelia.

Other branches of the study will suggest themselves to those who care for the subject, and I propose to give a sketch of the primitive plow and its immediate successors from examples at the Paris Exhibition.

Passing over the mere hoe and the long forked stick, to which the ox is attached to one branch while the point of the other roots in the ground, as shown in the pictures of ancient Egypt, we come at once to the plows shown in the exhibit from the colonies of the Netherlands.

Three pieces of wood constitute the plow in *a* and *b*, with an additional piece in *c*, where the mould is not merely the hewn face of the block, but is a piece fastened on—a mould-board, in fact. Such a tool will last longer in the wet rice fields of Java than in dry, stumpy, or stony ground, and we can hardly despise the implement when we reflect that rice is in that island the principal food of 17,000,000 of people. We sometimes think of these out-of-the-way places as if they were wilds, but in this island there are 337 people to the square mile, living under their Dutch masters, who keep the peace, manage the whole estate, and make money out of it. If they had had our Indians they would have settled them on cotton farms in Texas, corn farms in Kansas, and wheat farms in Minnesota. They would have made money out of them or given up the contract.

The plow *d* shows a change in design, and it is, in fact, of Chinese origin. The Celestials are so much pressed for room that they are overflowing into other countries. We are disturbed about the Chinese question, but all over Malaysia this people is flooding the avenues of commerce and pursuing the handicrafts of the region, even crowding the farmers and peasants.

The plows *a*, *b*, *c*, are for oxen, which walk one each side of the beam, the yokes *e*, *f*, *g*, being attached to the end of the pole either by pins or lashing. The tails of the oxen are almost within reach of the driver's hand in these cases, but with the plow *d* it is different. In this case the ox is attached by traces to the end of the plow beam, as with us. We shall find some plows from China further on; *d* shows the effect of the Chinese immigration, which seems to have been good, if improved tools be any object.

The yokes of the country are shown in Figures *e*, *f*, *g*. In two of the examples a rope of hemp, manila, or rattan is used to go beneath the throat of the animal and keep the yoke on his neck. In the other case a wooden neck-plate is slung by rattan rings from the yoke, and forms a smooth and broad bearing, much more agreeable, doubtless, to the animal than a rope. No horses are used in this Oriental country for work, and if they were, they would be yoked. It was so in ancient Egypt. The oxen did the farm and wagon work; the horses were for riding or for chariots. In the latter case they were yoked like oxen and drew by the pole of the chariot, just as cattle would, there being no traces. The yoke rested on the crease of the neck, in front of the withers, and was held in position by surcingle and neck-band.

Here comes a variation. Even in Java, it seems, with all its immobility, people learn to improve things, or, at all events, to change them. Like the plow *d* those shown at *h*, *i*, are adapted for one ox. If the animals were really large and well fed, one of them would be abundant for any of the work for which they are used, but really they are small buffaloes, and are never cared for as we consider care. In India, and probably the same may be about true in Java, the man catches his animal and gets to work about 6 in the morning and works till 11; then turns the ox loose to browse and rest for four hours, when he resumes labor till sundown. The ox then has a chance to find his supper and rest till daylight again—rather a stupid time for both of them. However, for most of us one day is but a repetition of another, and the world is but a workshop.

The plows shown at *h* and *i* are similarly arranged for a single animal, which walks inside of the frame, the bow resting upon his neck, in front of the shoulders, like a sort of collar. It is no doubt fastened by some kind of a cord, but such was not shown upon it and I abstain from adding any thing. Even with all this draught frame, yoke, side-bars, plow, and handle, there are only nine pieces, and these are such as an ordinary workman would be able to make. A man makes his own tools in the lands we are speaking of. The plow *h* has a block shaped with the ax to form share, mould, and landside. Into it the handle is stepped. In the plow *i* a knee-shaped piece of timber has been selected, and to it are fitted a hewed piece for share and mould, and another piece for handle.

All the periods of the world, so far as development of mechanical ingenuity are concerned, are upon us at once. We may talk of the wooden age, stone age, bronze age; they are still existing. The Australian has little besides wood for

weapons, and only a stick for a spade. Stone adzes and axes are at the present day made and used in Malaysia, Angola and many other places. In the United States territories, New Zealand and elsewhere, stone weapons have not yet disappeared, although the white man's metal is preferred. It is so with instruments of tillage.

The plows shown from Java are like those of our ancestors. The Greek and Romans used similar tools, and they are yet in use in Spain and Italy, scarcely modified in shape, but in some cases with a more liberal use of metal. In fact the most modern still preserve the general outline of shape, beam, share and handles, and there is probably no form shown from the Isles of the Eastern Seas but has its congener in some of the less known regions even of Europe.

The lands we have been referring to are great rice-growing countries, and the wet system of culture, where much of the work is done in the mud, will permit such tools as we have shown to be used with the limited animal power accessible. The vast alluvial grounds are "scratched with a stick and laugh with a harvest." Implements even more crude than those shown were formerly used in Egypt when the wheat and barley were sown in November, on the mud left by the retiring Nile, and harvested before the flood returned in June. And yet Egypt supplied Rome, and the people of the Imperial City had to scatter to find something to eat when the supply from Egypt was no longer theirs.

The harrow of Java is shown at *m* and needs no special description; it is a large rake drawn by a yoke of buffaloes. *k* and *l* are hand tools, the former showing the Japanese method, common in China also, of putting a shoe of iron on to the wooden hoe. *l* is a pick of which the elbow is strengthened with a leathern covering and lashing. *j* is a detached view of a wooden block for a plow, looking down upon it vertically. It is adapted for such a plow as *c*, for instance. It has a share of harder wood tenoned in.

The plows of China, to judge from those exhibited at the Exhibition, all have iron for shares and mould board. The plow *n* has a single thin plate of metal, bent so as to both raise and turn the earth. The plows *p*, *q*, *r*, on the contrary have two metallic plates, one for share and the other for mould.

There is also another feature of the Chinese plow, that its beam is strengthened by two uprights instead of one, both framed into the sole-piece. The plow *d* does not void this statement, for it is a Javanese plow made by a Chinese immigrant, or copied from one. The figures *p*, *q*, *r*, show some different methods, but will readily be understood without lengthy description. The plow *r*, it will be observed, has a block in front which slips upon the ground and serves as a gauge of depth for the share.

To show three approximations to the modern improvements, the plows *s t* from Spain and the plow *u* from Italy are given. The plow *s* is of iron excepting the extension of the beam, and the single handle; *t* is the cruder and follows the old wooden form very closely. It has a sole-piece framed to the heel of the bent beam; a share lying upon the sole, and slightly inclined; a plate bent into the shape of a hollow half cone and throwing the earth both ways. It is a very heavy, clumsy and inefficient implement, and no better, excepting as it is stronger, than in the days when Spain was conquered by the Romans; and a gallant defense they made of it.

The plow *s* is much like the former, but has a better mould, throwing both ways, however. It has a colter, which is an advantage both for strength and for work. It also is all iron excepting the extension beam and handle. These plows are about twelve feet long, and each has a two-wheeled carriage in front to hold up the front end of the beam. The team is attached to the carriage, and from the latter a draught chain passes to the plow.

Last and largest is the Italian plow *u*, 16 feet long, the handle being nearly half, seven feet. From the point of the share to the end of the landside is about six feet. It has a forecarriage, the wheels of which have a gauge of four feet and are strong enough to carry a ton. The draught chain is like a log chain, and it is to be hoped that not less than three or four yokes of cattle are to be hitched to it for work.

All the plows we have considered are plows of the present day, used in various countries, but would form a historic group if so desired. We shall next take up what are not more modern, so far as date is concerned, but those which are of better quality.

EDWARD H. KNIGHT.

Paris, July, 1878.

OUTWARD MARKS OF A GOOD COW.

By CAPT. JOHN C. MORRIS, of Susquehanna County, Pa.

THIS subject to me is very familiar, and has been for the last twenty-four years. It is going over the same ground that has been gone over in every conceivable form that man's imagination could place it in, and always striking at the same points. Nevertheless, it will have to be repeated over and over again until every dairyman and dairyman's son is impressed with its importance and interested in the dissemination of such knowledge.

The growing magnitude of the dairy interests of our State is probably only realized by a very few, even of the most sanguine. I admit that I was ignorant of the extent of it in the western portion of the State before being called upon to investigate this subject, though living in a dairy district myself—Bradford, Susquehanna, Wyoming, and Wayne all having a reputation for their fine butter and cheese, and living very much upon that interest. With all this reputation, I do say that I doubt very much if there is any other class of business that, as a whole, is done in seemingly so indifferent a manner.

There is no animal that has been bred so carelessly for the business for which it was intended as the milch cow, and no class of men so blind to their own interests as the dairymen. They are, as a general rule, purchasing, feeding, and milking cows which barely, if at all, pay for their keeping; raising calves of the same sort from cows that are not fit to breed from; using sires without the least consideration whether they are from good milking families, or asking the question whether their dams ever gave any milk. With this reckless way of breeding, how is it to be expected that dairying can be a success?

To breed superior cows for the dairy the first point is to select your cows regardless of race, but do not purchase a cow because she is cheap—they seldom if ever pay in a dairy.

Such as have shown themselves to be deep, rich milkers, whose antecedents have shown and proved themselves good cows, and who stamp the same characteristics upon their offspring, seldom, if ever, miss, providing they have a fair chance. By selecting a bull from a cow of the same good qualities and raising your own calves, I will guarantee that in a very few years you will have a herd of cows that will not disappoint you either in quality or quantity of milk, providing you give them the proper food and enough of it to manufacture milk from, for you are all aware that the cow is but a machine for converting vegetable substances into milk.

It is not always the handsome cow, I will soon describe to you, that gives the largest quantity or the best quality of milk, for I have seen among the natives some very ordinary ill-shaped cows that were extra fine milkers; but they, like all other good cows, were well marked, both in the escutcheon and the lacteal veins. I would breed from such a cow, using a thoroughbred bull with undoubted milking qualities, for it is an easy matter to breed all the fine points as far as beauty is concerned.

If the judges at our county and town fairs were men who understood the points and marks of a good dairy cow, and would not have their judgment swerved by the general outline of symmetry and other points of beauty in the animal, but would carefully examine the texture and turns of the hair, the skin, flesh, and other signs and marks, and decide according to that rule, showing and explaining to the inquiring minds why they have given the premium in the case, they would be doing their county or town, and in fact the whole country, a lasting service. On the contrary, I am sorry to say, there is very little regard shown in selecting judges as to their qualifications to decide intelligently upon the subjects required of them—many of them showing little or no knowledge of the business before them.

There is another point to be looked after, and that is the care and training of the heifer the first year after her coming into profit. A good heifer can easily be spoiled by careless milking and allowing her to dry up after being in milk a few months, for she is very certain to go dry at the same time ever after. She should be well fed and milked nearly up to her coming into profit the second year. All cows are inclined to deteriorate, and nothing but good breeding and care will keep them up to the standard you wish to have them in for milk; and you must not forget the color of their hair, horns, or muzzle.

The best cows are of medium size, as a rule, and small boned. The head is small and rather long, with thick, wide lips, which give the muzzle a flat appearance; eyes large and bright, with a placid expression; ear large and thin, with soft, silky hair, and with rich orange-colored dandruff on the inside; horns set on a high pate, inclining forward at the base, and light, tapering, and clean—the annual rings not deep (though depth of the rings indicates the condition in which the animal has been kept during the year; when well kept they are indistinct and blended together); neck long, clean, and thin, but not slender—well cut up under the throat, and thickening as it joins the shoulder, giving the shoulder a finished appearance; the brisket rather thin, well down, and clean from the dewlap; shoulders should be thin at the top of the blade, broad at the points, which should be nicely rounded—the shoulders lower than the hips; forelegs clean and straight and equally placed under the shoulders; back inclining upward toward the hip; chine full, which gives a full appearance to the crops; ribs rather straight and flat, full over the heart, showing a strong constitution, for everything depends on that in a milch cow. Loins broad and hips wide and high, rumps up even with the hips, though I have seen very good cows with low rumps, but they have in every case been otherwise uncommonly well marked. Pelvis should be wide, giving plenty of room for the tail; twist wide, but well cut up, which in all good cows must be the case to give plenty room for the udder. Thighs thin: the hind legs should be a little crooked, fine below the hock, with a good sized long foot. Dr. Loring, of Massachusetts, says, "No cow can do the work of a dairy that has a small, short foot." The tail should be long and tapering, but I cannot find any required length necessary. The udder should be long and broad, well set up between the thighs, with good-sized teats set well apart. The belly should sag a little in front of the udder and rise as it approaches the brisket, and should be large as compared with the size of the cow.

Now, after this general description of the handsome cow, we will go to the points which I am called upon to detail to you, and without which there can be little or no milk—for *all good* milkers have them. The hair must be soft, indicating a soft, elastic skin, which you will find to be the case by taking the skin in your hand, and if it be soft and pliable like a kid glove, you are safe for either milk or beef. If, on the contrary, the skin feels harsh and hard, with a crackling sensation as it passes out of your hand, let her or him alone; you can have neither a good cow nor an animal that can be fed for beef. You never saw soft hair grow upon such a skin. This is the first test.

Next pass your hand under the belly of the cow, and you will find the so-called "milk veins." They are an infallible indication of the good qualities of a cow; the larger the veins the better are the indications. In a very good cow you will sometimes find the veins branching off and making four instead of two, but they always join again before reaching the udder. The larger the veins, and the more irregular or angular they are, the more sure you are that the cow is one of the first-class milkers. You will find two orifices in the belly of the cow where these veins enter, and they will be in size according to the size of the veins; they should be of the same size or she is a blemished cow.

We will now go back to the udder, which should be covered with a soft, downy coat of hair, and in front of it the hair begins to turn its course back between the teats. Its width is to be examined, for the wider the belt the better and surer are the indications. This belt, or mirror, runs up to the pelvis, and must be examined, as the width without a break is the point in which Guenon forms his opinions as to his best cows, to which he gives the name of "The Flanders Cow." That, with the width on the thigh, is a sure indication of the best cows. I never saw it fail; the only trouble is, there are but few cows that have it in a perfect form. There are exceptions such as Guenon calls "The Bastard" and "The Bogus Cow," whose marks I will here explain.

The marks on a "bogus cow" are just the same as they are upon any of the classes, to all appearances, both in escutcheon and in their milking qualities. They are fine milkers, as far as quantity is concerned, for the first two or three months, or until they are again in calf. Within two or three weeks they begin to lessen in quantity and quality, and in a couple of months they are worthless for the dairy. This I know, not only from inquiry, but also by ocular demonstration, for I have such a cow in my own dairy and have kept her for three years, experimenting upon her. As long as she is kept from breeding, she is as good a cow as I have for quantity of milk, and of fair quality until after she gets with calf. This cow, as I said before, has all the marks of a Flanders cow—large, knotty milk veins, large wide escutcheon, running wide and full up to the pelvis; two mirrors, large and well formed, but upon examining the escutcheon closely I found the hair through the center of the escutcheon and up the pelvis long, coarse and bristly, different from any other cow I have in the dairy. The skin has a lightish red appearance. What little dandruff there is is dry and hard, very much of the road dust appearance.

I have found but few first-class cows of the bogus kind, where they were born so, but I have found several that were made bogus by bad training and careless milking.

THE MOST PROFITABLE BEE TO KEEP.

THE United States Government a few years ago was so favorably impressed with the importance of the Italian bee and its superiority over the native bee, that they made some importations through the Patent Office Department, at a very heavy expense. Their superiority consists, first, in their being more prolific; second, that they swarm earlier; third, that they are more hardy and endure more cold and consequently work earlier in the day and later in the season; fourth, that they store more honey, and store honey when black bees starve; fifth, that they are stronger, have a longer proboscis and can reach the bottom of cups of flowers that black bees are unable to. This may be tested by placing wire cloth over a glass filled with honey and placed in the apiary where both blacks and Italians may have free access; the Italians will be found drawing from it after the blacks have deserted it. Sixth, they are more vigorous and vigilant in defending their stores; seventh, they are more tractable and less liable to sting. This season has fully demonstrated to every practical bee-keeper, in Southern California at least, their superiority over the black bee. Practical observations during the present disastrous season have more than doubled our confidence in and admiration of the golden Italian, which is worth its weight in gold. Infusing pure Italian blood in a native colony is infusing new life, energy a new spirit of industry and economy into the hive, which we find practically illustrated in our examinations recently made, which showed that honey is stored as a general thing in proportion to the amount of Italian blood in the colony, the pure Italians having the greatest amount and the blacks the least. Italianizing or changing black bees to Italians is another very important feature in the science of apiculture. The queen is the presiding head of the colony and the mother of all, consequently they are of the same blood. When a pure Italian queen meets a black drone her working progeny will be hybrids, while her drones will remain of the same blood as herself, as fertilization never affects the drones, hence the necessity of pure drones to perpetuate pure stock.

TO ITALIANIZE A COLONY.

First remove the black queen. About 24 hours after introduce the Italian queen after the manner heretofore stated, when in about 21 days the entire colony will be Italian bees. The colony from which the Italian queen was removed will, as soon as they find themselves queenless, proceed to rear another, and will build from five to fifteen queen cells, which, after they have been capped over, may be removed or transferred to other queenless colonies that have been twenty hours or more without a queen. Great care should be taken that not the least damage should be done the cell, which must be cut out with a sharp knife and a corresponding hole cut in the comb in the hive to which you wish to transfer it, in which place the cell in its original position as near as may be; the bees will at once wax it fast and nurse it until the queen appears. The primary steps in Italianizing should be taken early in the season, before the queen commences to lay drone eggs, by cutting all drone comb from the black colonies, and thus prevent the rearing of any black drones; or, what might be better, take the drone comb from the black bees and give it to the Italians until filled with drone eggs, when they may be returned to the hives from which they were taken, where the bees will hatch them out. This plan may be pursued where many drones are wanted.

UNITING COLONIES

is another very important matter which we cannot pass by, as the present disastrous crisis in agriculture renders it very essential and important to be understood. Colonies that become too weak to be self-sustaining should be united, which may be done with perfect safety by first alarming the bees in both hives, that they may fill themselves with honey, which will render them more sociable. After this operation, which takes but a few minutes, they may be sprinkled with sweetened water, or peppermint, or other pleasant and odoriferous liquids, which will serve for a time to render the bees all of the same scent, making it for the time being impossible for them to distinguish each other. The top of one hive may then be removed and the frames lifted from the other and the bees shaken into it. The best queen of the two should be preserved. All comb containing brood or honey should be transferred to the hive with the bees. All empty comb should be preserved, as its value can hardly be estimated when we consider that every pound of comb is equal to twenty pounds of honey, or that the bees will store twenty pounds of honey in the same time they are building one pound of comb, hence the valuable acquisition of comb foundation, which commends itself to all practical bee-keepers. This subject might be pursued to much greater length, but let it suffice to say that the new light that has been shed upon this pleasing and interesting branch of science by a Huber, a Dzierzon, a Siebold, a Langstroth, a Tupper, a Harbison, and a host of others, has made this branch of industry both pleasing and profitable. The new demands for honey in Europe and America have stimulated it to more rapid strides upward and onward until it no longer is considered in the light of insignificancy, but has now assumed a character of national importance.—N. LEVERING, *in Los Angeles Herald*.

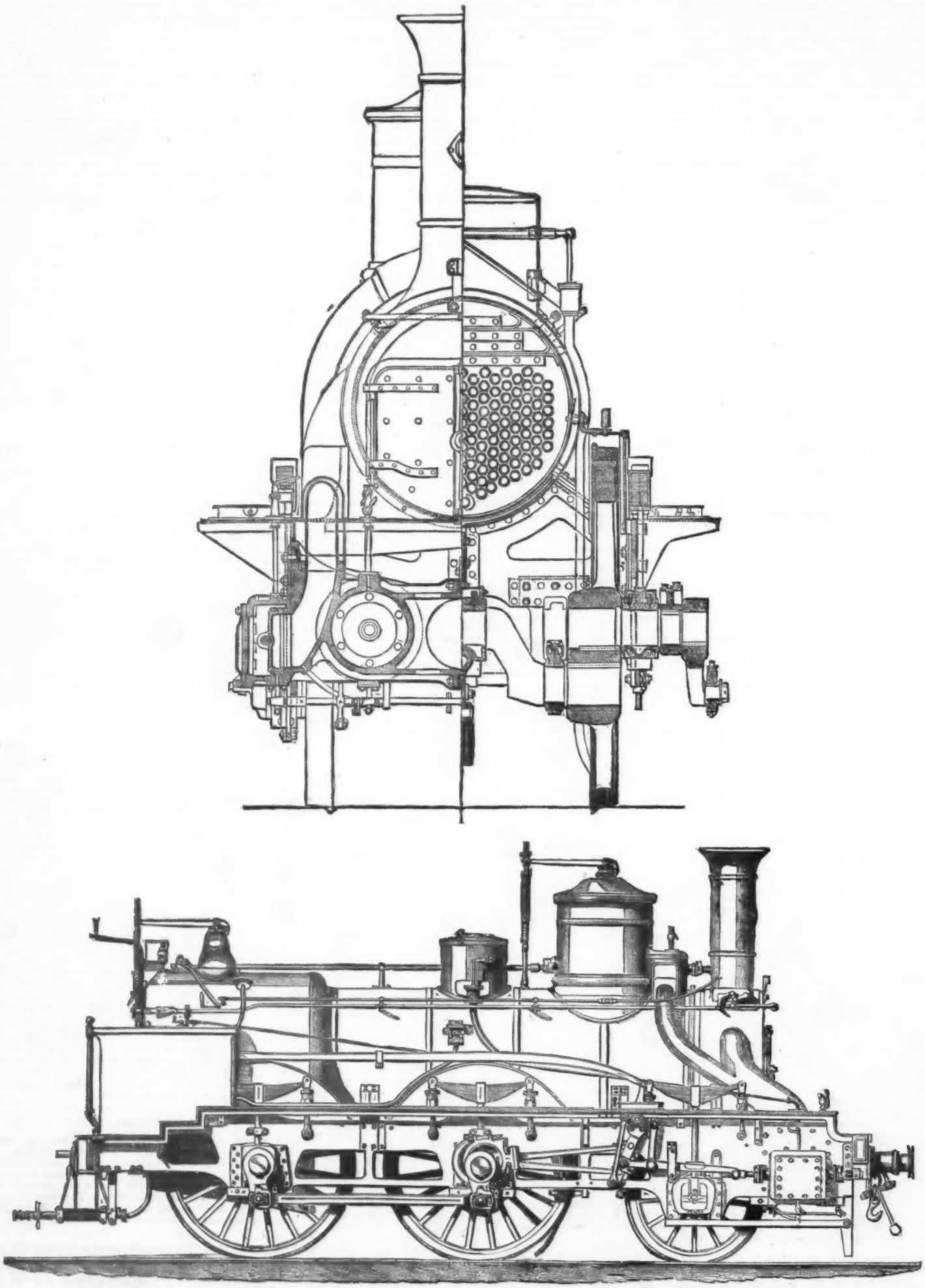
A NOVEL SALUTE.

A NOVEL salute was fired at Nacoochee, Ga., on the Fourth of July by General Thomas D. Johns of New York, who is engaged in removing some heavy shoals of rock in the river at that place. He prepared thirty-seven heavy blasts charged with giant powder, and gave a fine national salute with time fuses at 30 seconds interval. The effect was grand: the reports, reverberating through the Blue Ridge Mountains, were heard at a distance of ten miles.

A VERY serious attack is now being made upon the admirable patent laws of the United States. If it proves successful we have no hesitation in saying that the industrial progress of that country will soon begin to flag, and that great encouragement will be given to those who in England and in other European countries are seeking to rob the inventor of his rights.—*Chemical Review*.

LOCOMOTIVE ENGINES AT THE PARIS EXHIBITION.

THE locomotive engine which we illustrate this week was constructed by MM. Ernest Gouin et Cie. for the Western Railway of France. The engine has inside cylinders and outside valve gear. The valve chests come through the side frames, and the eccentrics are keyed on the driving axle just inside of the outside cranks. In English practice—as, for example, on the South-Western Railway—the cylinders are outside the frames and the valve chests inside. In M. Gouin's engine we have a complete reversal of this system of construction, the valve gear taking the place of the connecting rods and slide bars; and it will be seen that, while some objectionable features are entailed, the arrangement has, on the whole, a good deal to recommend it. One of the principal objections to the inside cylinder system of construction is that it is practically impossible to get in a pair of cylinders more than 17½ inches in diameter without placing the valve faces at an angle partly above or below the cylinders. This type of engine is extensively used on the London and North-Western Railway, and is by no means to be commended. If, then, a locomotive is required with cylinders more than 17½ inches diameter, these must be put outside. We shall not now attempt to discuss the relative merits of outside and inside cylinder engines. The fact remains that if inside cylinders are used, the space for the valve-chest must be made narrower and narrower with each increase in the diameter of the cylinders. This difficulty has been completely got over in the engine we illustrate. The cylinders are inside, and might be made of almost any diameter up to 20 inches; yet for some reason, which we confess we do not fully comprehend, they are only a small frac-



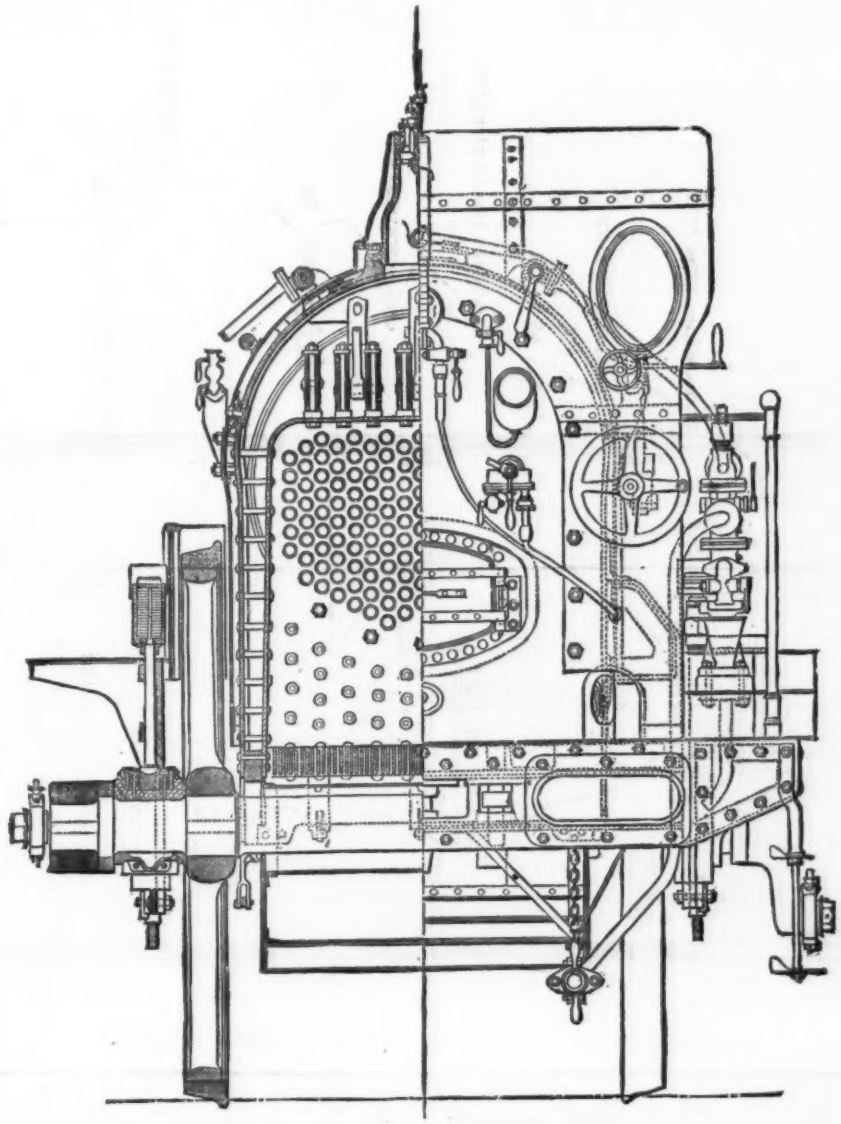
LOCOMOTIVES AT THE PARIS EXHIBITION—PASSENGER ENGINE, WESTERN RAILWAY OF FRANCE.

tion over 16 inches diameter by 23 inches stroke. When we compare these dimensions with the weight of the engine—36 tons full—we are forced to the conclusion that the locomotive is very heavy indeed for its power, and that much of the advantage which might have been gained from the arrangement of its mechanism has been given up. As we proceed it will be seen that there are certain points concerning proportion about the engine which are not consonant with English practice; but, for the present, we have only to deal with the design as one rendering the use of large inside cylinders compatible with direct-acting valve gear. The engine has three longitudinal frames, and the use of the third frame gives the most ample facility for making the cylinders perfectly secure, as the intermediate frame may be run between them, and each cylinder will then be bolted between two frames, and thus made as secure as possible.

A great objection frequently urged against the inside cylinder engine is that the crank shaft is very expensive, and very liable to break. It is claimed that this difficulty is quite overcome by the use of Martin's half-crank, as fitted in this engine. It will be seen that the driving action of the pistons is brought close up to the wheel, and that there are but two crank cheeks instead of four. This system of making crank shafts is, we believe, peculiar to the Western Railway of France—at least, so far as our knowledge extends, it is used on no other line. It differs in certain respects from the half crank patented by Baldwin, the founder of the Baldwin Locomotive Works at Philadelphia. The Baldwin crank shaft was made with two cheeks at right angle to the axle and the crank pins, and the latter were keyed into the wheel bosses direct. The frames of the Baldwin engines were outside, but the cylinders were inside, the connecting rods working as close as possible to the inside faces of the driving wheels. This arrangement was used for many years on the New York and Erie Railway, for 17 inch cylinder express and 18 inch cylinder goods engines. In 1847 Mr. Slaughter, of Bristol, patented in this country Denham's improvement on Baldwin's system. In the Denham crank shaft two cheeks for each crank were retained, but one cheek was half sunk in the cast iron driving wheel boss, which seems to have been cast round it. Very few engines were made on this plan, and the results obtained do not appear to have been very satisfactory. The Martin crank, it will be seen, has no crank cheeks proper of any kind, and it has a central bearing. About the use of this bearing merely as a steadier there can be little difference of opinion, but we much doubt the advisability of making it carry any part of the weight of the engine. However, we understand that the arrangement is found to work very well and to give much satisfaction.

The general arrangement of the engine is so fully illustrated that no special description is necessary, and we may proceed at once to give its leading dimensions, which we have arranged in the following table:

Outside fire-box:	
Length	5ft. 11in.
Width	4ft. 1¼in.
Inside fire-box:	
Length	5 ft. 2¼ in.
Width	3 ft. 6⅛ in.
Crown from grate	
Back	3 ft. 5 in.
Front	3 ft. 11 in.
Grate:	
Area	17.5 sq. ft.
Tubes:	
Number	156
Length	12 ft. 7½ in.
Diameter outside	2 in.
Heating surface:	
Fire-box	76½ sq. ft.
Tubes	1015 sq. ft.
Total	1091½ sq. ft.
Height of center of boiler above rails	7 ft. 1 in.
Weight of engine:	
Empty	33 tons
In steam	36 tons
On four-coupled wheels	25 tons
On leading do	11 tons
Engine:	
Diameter of cylinder	16.1 in.
Length of stroke	22.83 in.
Distance apart, center to center	3 ft. 3 in.
Diameter of driving wheels	6 ft. 1¼ in.



LOCOMOTIVES AT THE PARIS EXHIBITION—PASSENGER ENGINE, WESTERN RAILWAY OF FRANCE.

It will be seen from these figures that more heating surface is allowed than would usually be allotted in this country to an engine with 16 inch by 23 inch cylinders; and the four coupled wheels are also rather larger than we should use under similar circumstances. It must be admitted that the weight of the engine, great as it is, is admirably distributed. The workmanship and finish are excellent, and, taken altogether, the engine has much to commend it to English eyes. But the design is evidently better adapted for a very powerful locomotive—say, with 18 inch by 26 inch cylinders, and four coupled 7 ft. wheels—than it is for an engine of comparatively small capacity, such as that which we illustrate, the tractive power of which is not more than 80 lb. per pound of cylinder pressure. It must be borne in mind, however, that the fuel used is not equal to our Welsh coal, and, consequently, that the boiler is not, perhaps, under the circumstances, too big for the cylinders. These last seem to be the weak point about the engine, judging by English practice. There should be adhesion enough and steam enough for cylinders at least 1 inch larger in diameter and 1 inch greater stroke than those actually in the engine.—*Engineer.*

A DIVING DOG.

THE Ellenville (N. Y.) *Journal* says: "The captain of the canal boat P. H. Hanley, of Ellenville, has one of the most remarkable dogs. He is extremely fond of being in the water, and is a noted diver. He is known to have dived to the depth of 25 feet and brought up a piece of iron thrown overboard. On Monday a piece of wood and a piece of iron tied together were thrown overboard, and to them was attached a small line with which to haul up the dog when he had recovered the former articles. He gathered himself up in the style of a man or a frog when entering the water, and after being under for a long time appeared with the wood and iron in his mouth, and was hauled on board the boat, hanging by his teeth to the wood attached to the rope. He has only one known rival at this business, the latter being a Newfoundland dog owned at Verplanck's Point on the Hudson. Hanley's dog is a brindle bull-dog. The distance the iron was sunk on Monday was 19 feet. The Captain claims that the dog saved him from drowning at one time."

STEEL ARMOR PLATES.

THE London *Times* says: "An important trial of Sir Joseph Whitworth's impregnable armor-plating has just been made at Manchester. This armor-plating is formed of his fluid-compressed steel, and is built up in hexagonal sections, each of which is composed of a series of concentric rings around a central circular disk. The object of this construction is to meet the only weakness of the steel, its liability to crack; for the concentric rings prevent any crack from passing beyond the limits of the one in which it occurs. A small target, 2½ ins. in thickness, and representing one section of such armor-plating, was lately fired at with 3-lb. shot, with the result that all iron shot broke up against it harmlessly, and that a compressed steel projectile only indented its surface to a trifling extent. The experiment has since been repeated upon a larger scale, with a target 9 ins. in thickness, supported by a wood backing against a sandbank. In front of this target a horizontal iron tube was fixed to receive the fragments of the shot. The projectile was a Palliser shell weighing 250 lbs., and it was fired from a 9-in. gun, with 50 lbs. of pebble powder, at a distance of 30 yards from the target. Such a projectile would have passed through 12 ins. of ordinary iron-armor plating; but against the new target it was powerless. It broke up into innumerable small fragments; and, the target having been driven back 18 ins. into the sand by the impact, these fragments were able to escape at the end of the tube. They continued their movement of rotation in such a way as to cut a sort of trench through ten planks immediately in front of the displaced target, and then were scattered about in a shower. The only piece of any size which survived the shock was a flattened mass 8 lbs. in weight, formed from the apex of the shell, which was left imbedded in the surface of the target, where it had made for itself an excavation about 8 ins. in diameter and 1$\frac{4}{10}$ in. deep at the central or deepest part. Save for this shallow depression, the target was absolutely uninjured, the ring which received the shock not having cracked and no disturbance of the back surface having been produced. If this brilliant success should be confirmed by further trials, we shall possess in the new plating a lighter armor than any which is now in use for large ironclads, and one which will be invulnerable to any missiles at present employed in warfare."

THE BALTIMORE WATER WORKS.

In No. 19, Vol. 36,* we gave a sketch of the work in progress to supply the city of Baltimore with water. A recent visit shows that considerable progress has been made, and we take pleasure in laying before our readers further particulars of this remarkable work, which is called the "Gunpowder Permanent Supply" to distinguish it from the "Temporary Supply," from the same source, constructed in 1873, to afford relief to the city in case of a diminution of the regular supply from Jones' Falls.

The old water works, to which the new are auxiliary, consist of Lake Roland, which receives water from Jones' Falls and is capable of storing 400,000,000 gallons. This lake is seven miles from Baltimore and is connected by a conduit 3¾ miles long, having an area of 24⅜ square feet and a capacity of 3,750,000 gallons, with Hampden Reservoir, about three miles from Baltimore. This reservoir contains an area of seven acres and usually contains over 46,000,000 gallons of water. From Hampden Reservoir the water passes through three lines of 30-inch pipe, about 3,000 feet long, to Druid Lake, located in Druid Hill Park—the "Central Park" of Baltimore. This lake has a water surface of 53 acres, and its capacity is 493,000,000 gallons, its depth ranging from 20 to 65 feet. As the conduit between Lake Roland and the Hampden Reservoir is of greater capacity than the pipe lines above mentioned, a fourth line of pipe is now being laid to equalize the flow in the conduit and the pipe lines. It was originally designed to supply the city direct from the Hampden Reservoir, but as it was found that the water was frequently turbid, Druid Lake was constructed, having a capacity nine times greater than Hampden, by which not only was a greater purity of water and larger storage obtained, but a new beauty added to Druid Hill Park.

Baltimore, being a very hilly city, has a great variety of levels, so that it has been found necessary to create three different systems of supplying the city. One of these receives its water direct from Druid Lake, which is 217 feet above tide; another system receives its supply from a small reservoir called Mount Royal, of four acres surface, 30,000,000 gallons capacity and 150 feet above tide, which is situated between the city and Druid Lake, 3,625 feet distant from the latter; and the third system receives its supply from the High Service Reservoir, which is supplied by pumping either from Hampden Reservoir or Druid Lake, according to circumstances. The High Service Reservoir is situated 6,100 feet from Druid Lake, on high ground, in the park, being 350 feet above tide. It has a water surface of 4½ acres, and a capacity of 26,241,116 gallons. The pumping is done by two sets of compound engines and duplex pumps, built by Worthington, of a joint capacity of 6,000,000 gals. in 24 hours.

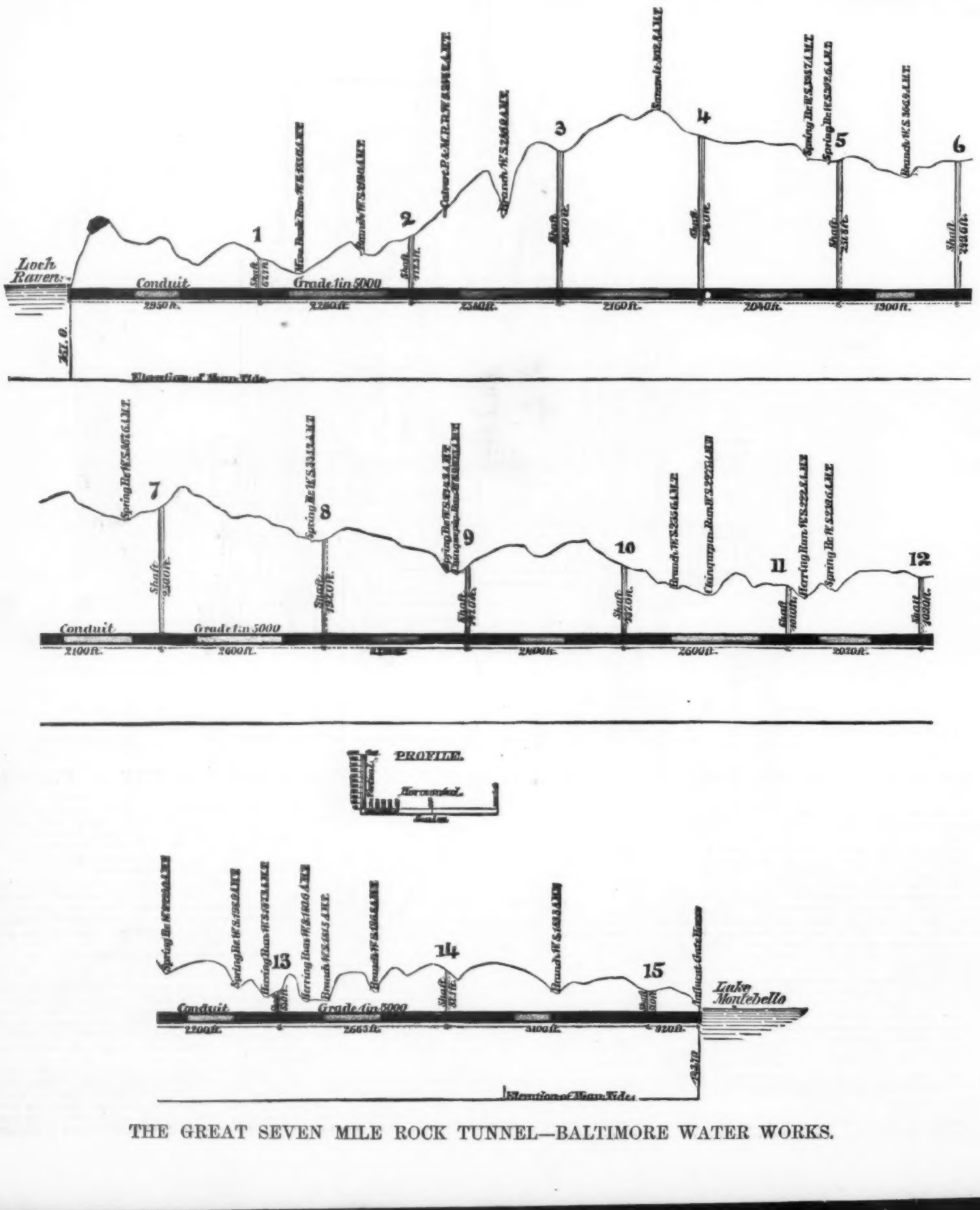
To the works above referred to there were added in 1873 what is known as the "Temporary Supply," which consists of an engine house located near what is now the head of Loch Raven, containing two pairs of Worthington's compound engines, each pair being of 175 horse power, and driving duplex pumps capable of pumping jointly 10,000,000 gallons of water every 24 hours. From these works the water is pumped over a hill 205 feet high, through a 36-inch pipe line, 3½ miles long, to a basin from which it flows along Roland Run two miles to Lake Roland and thence to the other reservoirs. This "temporary supply" is only used in summer time, when the supply in Lake Roland from Jones' Falls runs short.

The regular supply of water through the above works is about 15,000,000 gallons daily, but this proving insufficient the "Permanent Supply" was projected, which it is believed will give an average supply of 150,000,000 gallons per day. The works necessary to form this "permanent supply" may be divided as follows:

Loch Raven Storage Lake, in the bed of the Great Gunpowder Falls; the Dam for the retention of the water of the Gunpowder to form the lake; the main tunnel; the drainage tunnel; Lake Montebello Receiving Reservoir, and the Clifton Tunnel taking the water from Lake Montebello and connecting with the pipe lines to carry the water to the city mains.

Loch Raven will be, when finished, a lake varying from 500 to 1,000 feet wide, of an average depth of 20 feet and about five miles long. Owing to the devious course the Gunpowder pursues between the hills on each side of the valley through which it runs the lake will not be a mere reservoir showing man's handiwork all through, but will present the appearance of a natural lake or rather river, running through a beautiful valley hemmed in with hills bearing large masses of trees of nature's planting. Along each side roads are being constructed, one of which is completed all but the finishing touches, which will not be given until the heavy hauling incidental to the construction of the dam, etc., is ended. Ten streams of various sizes empty into the lake, and where these intersect the roads bridges have to be provided, which are to be of different styles for each stream,

* Scientific American.



THE GREAT SEVEN MILE ROCK TUNNEL—BALTIMORE WATER WORKS.

to give variety of architectural effect. Across Peterson's Run, the most important of these streams, a white marble bridge of three semi-circular arches, each 20 feet span, having a roadway of 20 feet wide, has been constructed, and other bridges are being built as fast as the stone can be quarried, plenty of stone suitable for the purpose being found in the neighborhood.

The lower end of the lake is to be formed by means of a stone dam now in process of construction at a spot where the Gunpowder approaches nearest to Baltimore, which is about eleven miles distant from the dam. The Gunpowder here is about 145 feet wide, and it was divided in its center by what appeared to be only a large bowlder but afterward found to be the bed rock. From this rock to the east side of the falls a coffer dam was built and the stream forced through the narrow channel on the west side, there being sufficient room for the stream except in very high water. Inside of this coffer dam the excavations for the foundation and the erection of the masonry for the eastern portion of the dam have been conducted. The foundations throughout have gone down to the solid rock; the extreme depth reached below the present average surface of the water in the stream was 13 feet, and the height of the dam from the extreme depth to the crest of the overfall is 34 feet. The thickness of the masonry at the bottom of the dam is 65 feet, the face being built up of stones 4 feet long, 3 feet deep and 2 feet thick laid in hydraulic cement, against a core of heavy rubble masonry, backed by 165 feet of puddle clay, gravel and riprapping. The overfall when completed will be 300 feet across, and from this on the east side extends a wing 190 feet long and 8 feet higher than the overfall, built of heavy rubble masonry, which extends into a hill forming the bank of the lake on that side. More progress would have been made during the past year but for the severe freshets in the Gunpowder, which broke over the coffer dam and left a deposit of mud in the foundation which had to be cleared out before the mason work could be resumed. During one of these freshets the stream rose 13 feet above its average flow, breaking over the work already laid, carrying over it logs, stumps, trees, and debris of all kinds, yet owing to the solidity of the work not one stone was disturbed by the torrent.

The dam when finished will raise the level of the Gunpowder from its present average of 149 feet above mean tide to 170 feet.

From near the west end of the dam a tunnel is now being cut which is circular in shape, of 12 feet diameter and 36,500 feet long, or very nearly seven miles, which will, when completed, be the longest in the country. The accompanying engraving shows a profile of this tunnel with the different shafts and their depths from the surface, all of which are cut down to grade and the drifts well advanced in each, as will be seen on examining the work done, which is shown by the heavy black portion in the line representing the tunnel. The engraving shows the work done up to June 1, 1878, and it is believed that should no greater trouble appear than is yet anticipated the tunnel will be cut through in about fifteen months. The most serious trouble has been the amount of water that has been encountered in driving the drifts from shaft to shaft, and more especially at shaft No. 2 in the north or left drift, where comparatively slow progress has been made, as owing to the nature of the ground sections of ten and sixteen feet only could be taken out when the brick arch had to be put in to secure the advance. The water comes in here now in such vast quantities that the work in the drift has been stopped by it, notwithstanding that four steam pumps of large capacity are engaged in pumping. On one occasion the water came in so suddenly and so rapidly that were it not for the fact that the "cage" was at the bottom of the shaft just ready to ascend, the men working there would have been drowned before relief could have been had. Should the water continue to interpose obstacles to the progress of the work here, it may be necessary to abandon operations at this point until the tunnel has been pierced on the other side clear to the reservoir, when the water would readily pass away.

Trouble from water has been anticipated near shaft 13, under Herring Run. The rock here is thought to be not much over 12 feet above the base line of the tunnel, and it is believed that if the drift was cut to the full size the water in the run above could not be kept out. The drift is therefore cut only six feet high at this point at present, leaving the remainder to be removed when the tunnel has been pierced all the way to the reservoir, so that should the water break through there will be no difficulty in carrying it off.

The engineer has been fortunate in finding so much of the line of the tunnel running through hard rock which requires no arching or support during the work, about 29,500 feet being, it is believed, of that character, leaving only about 7,000 that will require arching.

The lower end of the tunnel terminates at Lake Montebello Reservoir, formed by stopping up the opposite ends of a valley admirably located for the use to which it is put. Around one side of this lake it was necessary to build a drain tunnel nine feet in diameter and 2,870 feet in length to carry away a stream of water known as Tiffany's Run which formerly ran through the valley now forming the reservoir. This tunnel has been completed at a cost of $97,102.96, and the stream of water it was intended to carry away turned into it, when it was found that notwithstanding some extraordinary heavy rainfalls the tunnel received all the water that came down the valley. This drain thus carries off all the impure water from Tiffany's Run and the surface drainage from the surrounding district, and can be used to empty the reservoir if necessary, leaving only the water that comes through the main tunnel from the Gunpowder to enter Lake Montebello, which when completed will form a reservoir of 80 acres in extent and of a depth of about 30 feet, having the general appearance of a natural lake, surrounded by a fine road from 60 to 80 feet wide and 1¼ mile long.

At the portion of the lake nearest the city is the efficient gate house, and from here the Clifton Tunnel commences, which is 2,975 feet long, and has more than five-sixths of its length completed. This tunnel is cut through soft material, which has made the driving and arching especially difficult, particularly at the south end, but as great care and caution has been exercised no serious accidents have occurred here and satisfactory progress has been made. Owing to the character of the material through which this tunnel is cut it requires lining with brickwork laid in hydraulic cement. Where the material of the tunnel is of tolerably good character the top arch is of three bricks thickness and the invert below the spring line two bricks thick, with a backing of from 18 to 24 inches above the spring line, built in against the timbers or the earth or rock sides of the tunnel. Where the material is very soft an additional ring of brickwork is added and the backing is increased in proportion. This tunnel is considerably below the level of the other or main tunnel, so that the reservoir may be entirely drained through it should it become necessary.

At the end of Clifton Tunnel is to be a gate chamber, from which will lead six lines of 40-inch cast iron pipes, to carry the water to the city limits, where the lines of piping will be connected with the present supply mains, thus giving a natural flow of water 170 feet above tide to all parts of the city except the extreme high ground in the northwest section, where the water will still have to be pumped into a high service reservoir.

We are indebted for the data on which this article is based to the courtesy of Mr. R. K. Martin, the Civil Engineer of the Water Department of Baltimore, who built the old works in 1858, and who with a corps of able assistants, having the present works in charge, hopes in a comparatively short time to be able to report that he has completed the longest tunnel on this hemisphere.

WAVE LINES.

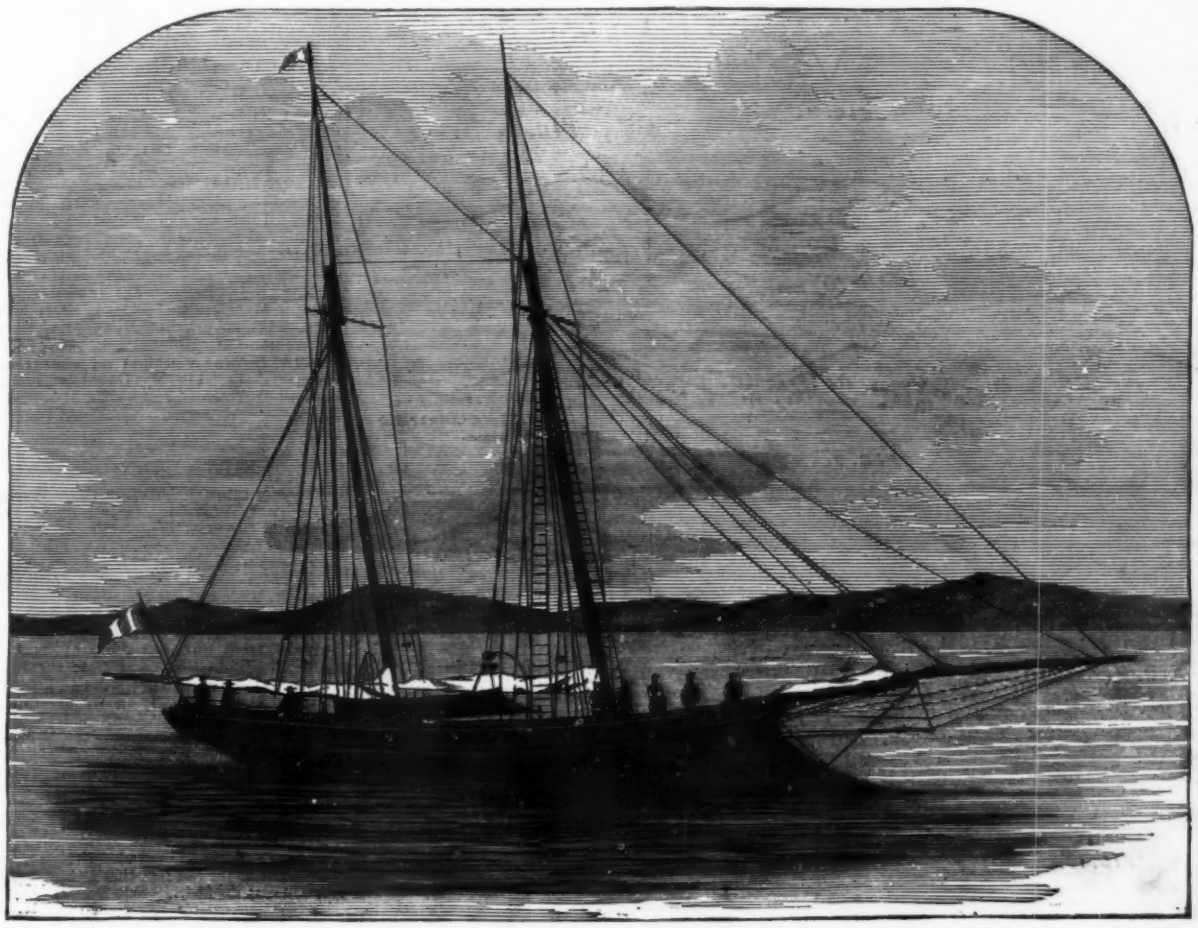
A SHORT DESCRIPTION OF THEIR TRUE FORM, AND HOW SHIPS OUGHT TO BE CONSTRUCTED TO MEET THEM.

By DR. J. COLLIS BROWNE.

As many questions are asked respecting the peculiarities of my patent ships, such as the objects for which they are built, the advantages gained over present forms, their mode of sailing, etc., a few words in way of explanation may be desirable.

My ships are designed for speed, safety, and comfort in all weathers, to reduce pitching to its minimum, to prevent opposition to the blows of heavy waves, and to gain speed.

As far back as the year 1854 I observed that when a vessel under canvas or steam was forced through the waves she raised or drove before her bows large volumes of water, and that this body acted largely in retarding her rate of speed, as it effectually overcame her momentum. On investigation, I came to the conclusion that this impediment was to be surmounted, as it rose from an error of construction of the ship. I thereupon commenced some experiments which satisfied my mind as to the correctness of my views, and proved most satisfactory in their results. Circumstances prevented me from making further investigations, but nevertheless I pursued the subject at various intervals, and was led to study the action of water in motion against solid bodies. After perusing the current works of the day, I found that the difficulties increased in solving the problem, so I cast them aside, and began anew for myself. At length I came to the conclusion that the true wave lines were to be founded on the application of two physical laws, which will sufficiently demonstrate the method of my proceeding, and the laws upon which I found my construction and theory of ship building, either for sail or steam, or both combined.



DR. COLLIS BROWNE'S YACHT KALA-FISH.

The physical laws that I bring to notice are:

1st. Law of specific gravity.
2d. Law of motion.

Now in introducing these laws, I only bring them forward in their utmost simplicity, so that the most simple understanding may comprehend their force and application, purposely avoiding all reference to technicality or abstruse matter as being unnecessary and only obscuring the question under consideration.

Now in illustration of the first law—

SPECIFIC GRAVITY,

or, as it is commonly termed in nautical language, displacement, let us take a flat piece of wood and float it (Fig. 1).

We now see it resting on the water, having only a little submergence at A and B. That little portion, then, determines its specific gravity or displacement, representing the true difference in weight between its own and the water on which it floats.

If we take the same sized piece of wood, but only alter the form to a triangular one (Fig. 2), we will find the same amount of displacement taking place, but only in a different way; there is precisely the same area of surface presented by the wood, only the form is varied. The triangle, A B C, will be exactly equal to the surface A B in the former figure.

Again, let us take the same piece as above, but reverse its position (Fig. 3).

At once a difference is noted; the apex, A, of the triangle, A B C, is uppermost, and highly elevated, while the base is only moderately submerged just enough to maintain its true displacement, or, that is to say, its equal bulk of water relative to weight.

Bearing this exemplification of specific gravity or displacement in mind, we will next proceed to the second law, or that of motion as applicable to waves, and it is herein that I claim the origin and application of the true wave line, and the unmistakable law that must govern the building and construction of future ships.

LAW OF MOTION.

In trespassing on this intricate subject, I confine myself only to that part which attaches itself to the cause and effects of the action of waves on ships' lines constructed on present principles or rules, and the difference of action realized on my plan of procedure.

If we observe the action of water, we find it in a state of quiescence, maintaining a horizontal line (Fig. 4).

Water, be it remembered, being constituted of molecular bodies (Fig. 5), forming in aggregation collected, vast oceans, now when these particles or molecules are agitated or set in motion they begin to revolve on themselves, and as the disturbance increases the horizontal line is broken and a series of what are called wave lines is formed. Now it is these wave lines which when interpreted form the whole key to the theory and action of the principles of my ship architecture, and which I feel confident must be accepted as being true, having their foundation based on physical principles, and proved by crucial experiment.

When water is set in agitation, we observe the horizontal line converted into lines after this fashion (Fig. 6).

On examination, we discover that these undulous lines have an onward motion given them from the direction of their motor force, and that the movement is on a plane with their surface, being made up of molecular particles; these like little wheels act one over another, producing that regular smooth action as is seen in a stream or current, but which when once diverted or obstructed causes an "embrouillement." These waves or undulations of course vary in height and force equally to that power which generated them, but they invariably correspond when analyzed to the angles herewith set forth (Fig. 7).

Each wave forms an angle of incidence and reflection, and as the angle of incidence is equal to the angle of reflection, we have consequently to adapt our construction of a ship in accordance to this law; moreover it is remarkable that wave lines form angles of about 25 to 40 degrees, and it is when their highest is attained that then only the curling wave so destructive in force is derived. Having explained the operation of these two laws, I will now direct attention to their practical application and operation.

Of late years there has taken place a great change in the form of ships, but at most they have only been modifications of those for ages in use, either making the lines finer fore and aft or giving a basin or flare to the bow, but in nothing have they approached the form of my patent ship. Hitherto the treatment of naval architecture has been based rather on the ideal and empiric. The scientific theory seems to have followed instead of preceding practice. My ship was founded and built on theory and its experimenta.

Whichever way we view a ship she presents but one aspect, that is, a V-shaped hull with an overhanging bow. Such is the rule that dominates, the exceptions being few, where U approaches the section or a straight line the bow, but take them either way they are radically wrong, as the following will show (Fig. 8):

Our illustration will be a full sized ship, perhaps of an approved design. Now what is seen here respecting the laws of motion and specific gravity?

1st. We have the bow presenting an acute angle to the wave meeting it (Fig. 9), consequently at an opposite angle with the line of motion of the water, prevents her from tumbling into the sea and pitching.

There is a totally different motion following the movements of the ship instead of a violent one; every action is easy, gradual, and smooth—a sort of gliding sensation is experienced as she goes through the seas. As for her sailing qualities, they are exceedingly great; for running, extraordinarily so. In constructing the vessel aft as in front the same power of flotation as in the bow is seen in scudding; a sea running after lifts instead of poops, the weight of water, coming sternwise, literally acting hydraulically by elevating her as she rushes from sea to sea.

An argument has been raised that as the bow forms an obtuse angle, the water must run up into the ship, as is seen in a breakwater on the shore where it slopes down to the sea; but those who use this argument forget that the breakwater is a fixed body, while the ship is still governed by the law of specific gravity, and lifted up and over them.

My first sailing ship was made in the summer of 1872, and in the spring of the year 1873 I had a steam launch built after this plan, 24 ft. by 3½×2 ft. 2 ins. in depth.

This craft would steam 8 knots an hour, and live in seas that would swamp a bigger boat—in fact she steamed one night from Deal to Dover against a gale of wind with heavy seas, so much so that when she was seen in Dover harbor next morning she was looked upon as a wonder, for it was believed no open boat could have lived in such a storm.

In March, 1872, the "Kala Fish," built after my patent, went to sea, and has proved herself to be a magnificent sea boat, meeting seas that would deluge other craft, while my ship would dash on regardless of them, the crew sitting on the bows smoking their pipes, or watching the waves as they slipped by her sides.

For two and a half years I have been testing and proving the qualities of this system, and am able to testify to its excellences. Numbers of people have now had opportunities of witnessing her in smooth and calm waters, and they are satisfied that the principle is correct. When I first proposed to build I met with some opposition, one builder declaring he would not have such a thing come out of his yard, others refusing—indeed, I met with anything but encouragement, and was looked upon as somewhat deranged, so completely had I ran counter to "authority" (whoever he or she may be). It was not till last year, in April, that confidence began to be felt in her, after I had the honor of reading a paper upon her at the Royal Cinque P. Y. Club, at which H.R.H. the Duke of Connaught, Prince Arthur, presided at a meeting for the purpose; since which time she has sailed into the Mersey, visited France, Portsmouth, Plymouth, and many other ports, been up and down the Straits of Dover and the Channel, and never once taken a sea into her.

[NOTE.—Dr. Browne has in some way overlooked the efforts of Mr. Darius Davidson, of New York, whose plans for vessels upon principles resembling the foregoing attracted much public attention on this side of the Atlantic in 1850–52. Dr. Browne will find an engraving of a side wheel steamer, designed by Mr. Davidson, called the Sword Fish, the hull of which resembles Dr. B.'s "Kala Fish," given in the SCIENTIFIC AMERICAN of June 12th, 1852.]

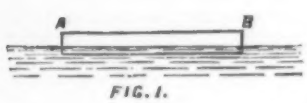


FIG. 1.

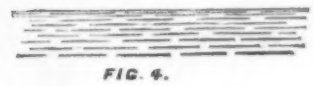


FIG. 4.

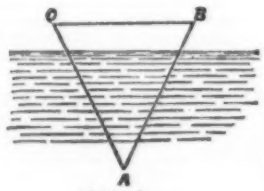


FIG. 2.

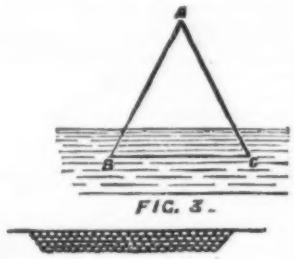


FIG. 3.

FIG. 5.

FIG. 6.

FIG. 7.

FIG. 8.

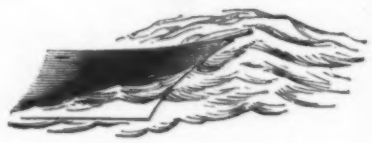


FIG. 9.

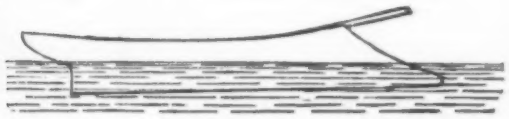


FIG. 10.

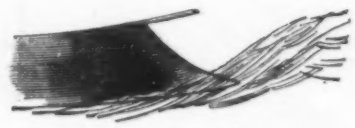


FIG. 12.

FIG. 11.

FIG. 13.

WAVE LINES.—BY DR. J. COLLIS BROWNE.

Now the principles I advocate for the construction of a ship remedy all these defects, and as my ship has tested them in many a heavy sea and gale, I am in a position to demonstrate their correctness.

In building a ship I construct her after these two forms (Figs. 10 and 11).

When my ship advances to the wave her bow presents at once an angle of reflection to the angle of incidence belonging to the wave (Fig. 12), the consequence being that she rises to it, the water passing off on either side, the wave and ship forming a plane common to both.

Owing to her peculiar formation forward, the base of the triangle, B C, as seen in Figs. 3 and 13, being on a plane to the approach of the wave which strikes the ship as an angle of incidence.

2d. We discover that her section is at right angles to her plane, the apex being deeply immersed in place of elevated.

3d. That her momentum is at right angles to that of the wave.

The result of all this is that the ship's progress is checked each time she meets a wave; that owing to the diminished power of flotation forward she becomes deeply immersed, and perhaps overwhelmed with huge bodies of water; that she "pitches" heavily and labors much in bad weather, and in fact becomes a wet ship at the best.

WHITE'S NEW YORK MALT HOUSE.

To enter into a disquisition on the antiquity of malt would be to write history for thousands of years. Pliny, in his "Natural History," book xviii., chapter 14, says that barley was one of the most ancient aliments of mankind. In the Scriptures we read (Exodus, ix., 31) that it was cultivated in Egypt nearly 1,500 years before Christ. Hippocrates mentions three different kinds of barley as being known in his time.

Malt is barley which has become sweet and more soluble in water, from the conversion of its starch into sugar by artificial germination, to a certain extent, after which the process is stopped by the application of heat.

Barley is too generally known to require a minute description. It is readily distinguished from other grain by its pointed extremities, and by the rough appearance of its outer skin, which is the corolla of the flower closely enveloping the seed, and in most varieties strongly adhering to it. According to ancient authors, barley formed a principal part of the food of man in early ages, and continues so to this day in many countries. In seasons of scarcity brewers in Paris have been forbidden to make beer of barley, so that the grain might be reserved entirely for food; this may probably account for the fact that as brewers of malt liquors the French are decidedly behindhand. One hundred parts of ripe barley contain 18·75 husk, 70·05 meal, and 11·20 water.

It is really surprising how very little information is possessed by the public at large on the subject of malting. We remember a remark once made by a legal gentleman connected with one of our local associations of brewers, upon hearing the prospects of the barley crop canvassed: "Barley—barley! What has barley got to do with brewing? I thought beer was made from malt, not barley." For the benefit of such we will enter into a few particulars respecting barley malt; and, indeed, it was for this very purpose that Mr. White caused a sectional diagram—scale, one-eighth inch to the foot—of his malting premises to be made and exhibited at the Centennial, in the Brewers' Building, and of which drawing we have availed ourselves in presenting the illustration.

The object to be attained in malting—for the benefit of the uninitiated—may be thus broadly stated:

First, to render the grain more soluble; and second, to develop a chemical principle, by germination, called diastase, which has the property, at a certain temperature, in water, of converting the starch contained in the grain into dextrine and saccharine; from which is further evolved, by fermentation, the stimulating, nutritive and invigorating properties to be found in good ale, porter or lager beer. The malting process also separates, to a large extent, light or imperfectly grown barley and other grain, or impurities, with which it may be mixed.

The New York Malt House was erected in the year 1856, and has consequently been in successful operation over twenty-two years. It was at that time the largest establishment of the kind, not only in the United States, but the world, having a capacity for malting 325,000 bushels in a season. The dimensions of the main building are 80 by 190 feet, and the store-houses and kilns are 60 by 160 feet. It was the first malt house erected in this country in which the grain is steeped on the ground floor and then elevated to the respective growing floors, of which there are five, including the ground floor.

Water is supplied to the establishment from five artesian wells. There are three steep-tubs, two capable of holding 2,000 bushels each, and one 750 bushels.

The raw grain is first put through a scouring, cleaning and separating machine, then run out of the bins into the steep-tubs, where it is allowed to soak for a certain time—how long depends upon the kind and quality or growth of the barley; as a rule it must remain until the grain can be doubled between the finger and thumb without breaking. The water is then run off and the moistened grain is laid upon the growing floors in a thick heap, at a temperature of about 60° Fahr., when it commences to germinate. This heap or piece, as it is technically termed, is then turned over, spread thinner over a large space, where it remains for another period of about twenty-four hours; it is then turned over again, spread thinner and over more space, and allowed to remain for another period; and, lastly, it is turned once more, spread about two inches thick, and remains until the acrospire or leaflet is grown sufficiently up the back of the grain from the rootlets. Germination is then checked by kiln drying, two of which kilns there are upon each floor.

The operation occupies twelve or fourteen days, and the different piece are turned over during this period about forty-five or fifty times, the three requisites for proper growth being air, heat and moisture, light not being necessary. The malt nearest the floor, on account of the surface grain, becomes heated, and grows quicker, hence the necessity of constant turning over.

Great care is taken while the grain is on the floor germinating to keep it sufficiently moist, and at an even temperature; non-attention to these essentials has spoiled many a floor of malt, and rendered it utterly useless for brewing purposes. During the season there are thirty-four men constantly engaged turning over the pieces of malt with wooden shovels, and the skill and dexterity with which this is done, to an unpracticed eye, is surprising.

The kilns, which have improvements entirely of Mr. White's or his father's devising, are heated by twenty-four furnaces on the lower floor, and the temperature can be regulated in each kiln to the greatest nicety.

Properly malted barley has a sweet, rich, mellow taste, such as is possessed by no other grain, and malt liquor produced from it has sterling healthy qualities surpassing any other beverage, not excluding wine. In fact, the cerevisin of the Germans and the ale of the English are in reality barley wine.

It has been asked, Are there no other cereals out of which ale or beer may be produced? Strictly speaking, there are not; yet, nevertheless, in times of scarcity or to meet certain exigencies of business, corn, wheat, oats and rye have been used, but not entirely—barley malt being absolutely required in certain proportions to effect a proper saccharine conversion of other constituents of the grain. Each cereal has a peculiarity entirely its own, and brewers well know that only sound honest liquor can be produced from good barley malt. Maltsters know no other, and the maltster who produces the best becomes celebrated, does a large business and obtains better prices, all of which is strictly true of the gentleman whose establishment we have endeavored to sketch.

Mr. Matthew White is well known throughout the trade for his extensive dealings, his strict probity, and his thorough business tact and habits. It may be said of him that he was born a maltster, his father, Mr. John G. White, being at the present time the oldest maltster in the United States, and one who has built eighteen malt houses, the first of which was in the year 1833, in the city of Albany, N. Y., where Mr. Matthew White was born, in the year 1834.

The consumption of malt is not entirely confined to brewers simply, but is now being largely used by pharmacists as a nutritive medical agent, calculated to supply, in a condensed form, a want of the human system. There are numbers of chemists now engaged in producing a concentrated extract of malt, and of malt and hops, which find a ready sale.

As the population of this country increases, as it necessarily must, the demand for barley malt will become greater, and such establishments as the one we have described will be regarded as more important to the well being of the community.—*Brewers' Gazette.*

ANDREAS VON ETTINGSHAUSEN.

WE regret to record the death in Vienna, on May 25, of Baron von Ettingshausen, one of the oldest of European physicists. He was born in Heidelberg, November 25, 1796. After the completion of his academic studies, he entered the philosophical faculty of the Vienna University as privat-docent for physics and mathematics in 1817. Two years later he accepted the professorship of physics in Innsbruck, but was called back in 1821 to Vienna, to the chair of mathematics, which position he exchanged in 1834 for the professorship of physics. In 1852 he accepted the direction of the newly-grounded Physical Institute, completed its organization, and raised it to its prominent position as a center of physical investigation. Some years since he was compelled by increasing age to retire from the duties of his professorship, after a half-century of unwearied activity.

As an investigator Ettingshausen was first known by his mathematical contributions. In 1834 he was one of the first to apply Faraday's discovery of electric induction; and the magneto-electric machine devised by him at this time, and bearing his name, marks an important step in the progress of this branch of physics. Of his later researches we would mention those on the movements in homogeneous systems of molecules, on the parallelogram of forces, on the law of isochronism in the vibrations of the pendulum, and on the formulæ for the intensities of reflected and refracted light, in all of which the mathematical element was predominant.

Ettingshausen's literary work was confined chiefly to his "Vorlesungen über höhere Mathematik," which appeared in 1827; his "Lehrbuch der Physik," published in 1844, and to the editorship of the "Zeitschrift für Physik und Mathematik," from 1826–1832.

As a lecturer Ettingshausen was one of the leading celebrities of the Austrian capital. His auditorium was thronged not only by the students but by the educated classes of Vienna, who were attracted by his rare combination of oratorical power and experimental elegance.

In the Physical Institute he rendered services of the greatest value. For a number of years Vienna was unexcelled in the opportunities it offered to young physicists, and the present activity in physical research existing throughout the Austrian universities is undoubtedly due in a great measure to the healthful impulse given by Ettingshausen a score of years since. It is probably to the same source that we can trace the marked mathematical character of the modern school of Austrian physicists, nearly all of whom have been trained under his eye.

Ettingshausen's varied services made him the recipient of numerous decorations, and some years since he was raised by the Emperor into the nobility. He was a leading member of the Vienna Academy of Sciences, which he assisted to found, and for a long series of years its general secretary. His researches appeared chiefly in its *Sitzungsberichte*. He leaves behind him a son, Baron Constantine v. Ettingshausen, the well-known authority on palæontology.—*Nature.*

JOHN D. PATTEN.

To the Editor of the Scientific American:

In the death of the venerable gentleman who is the subject of this sketch, the Patent Office loses one of its most ancient landmarks, the inventors of the country are bereft of a benefactor, while friends without number mourn the departure of "a brother, kind and true." Mingled with the sorrow we feel at his loss is the sharpness of the shock felt at the time, and still remaining, at his sudden "taking-off."

His death occurred on Sunday, the 23d ult., while in attendance upon divine worship at St. John's Church, Georgetown, of which society he was a member, and while uniting in the sacred service that he loved so well. Years had not withered, age had not weakened, and hard, persistent toil had set its seal but lightly upon him, although he had well nigh passed his seventy-second year. Death found him in the fullness of his years, yet in the full vigor of manhood; the dread summons came unexpected, yet found him not unprepared.

Mr. Patten was born in the city of Boston in the year 1807, and there he spent his boyhood. His reminiscences of those early days were a source of great delight to his friends, and seemed sweet to his memory. He afterward resided in New York and Ohio until coming to Washington, some twenty years ago. His life had ever been a busy one, continuing so up to the day of his death.

It is not our purpose at this time to give a biographical sketch; we merely wish to touch briefly upon his personal history as connected with his later years. Mr. Patten had become, in the fifteen years he had been connected therewith, so thoroughly and closely identified with the Patent Office, that his demise may be likened to the displacing of a pillar, or the dropping out of a corner-stone that cannot be replaced. It is but simple justice to say that he will be missed to a greater extent, both by the employees and by the patrons of the Office, so marked was his individuality and so peculiar were his duties, than would be the case at the death or departure of any other man connected with the Office. He filled a niche peculiarly his own, and which, in the eyes of his friends, must now forever seem vacant.

"Father" Patten was especially noted for great rapidity and dispatch in the discharge of his clerical duties; for great kindness of heart, courtesy of manner, and unfailing good nature. By these qualities of head and heart was he best known while living, and through them will he longest be remembered by those who survive him. Who that has once seen can ever forget the sharp, quick movement through the passage; the courteous bow and passing salute, invariably given; the scratch, scratch of the old gold pen; the erectness with which he sat at his desk, and the alertness with which he would gain his feet at being addressed? His sympathies were easily aroused, and he never seemed happier than when performing a kindness for a friend, or in aiding the poor inventor. By his painstaking efforts to promote the interests of the patrons of the Office, he has reared a monument to his memory which even time cannot efface. His letters were models of good advice and valuable information, couched in the choicest language and the purest Anglo-Saxon. What was worth doing *at all*, was, in his opinion, worth doing *well*. This was his guiding motto in all his official duties.

In his social qualities his friends ever found a perennial well-spring of delight. His cheery "Ah! coming up," as he came flying in at nine o'clock, was but the precursor of continued cheerfulness throughout the day. "Don't give them over a quarter, boys," he would say when leaving the room for a moment, "or I shall be unable to reimburse you." He had many odd sayings, peculiarly his own, which he loved to repeat, and never failed to apply them at the proper moment. "Scrape the bark of a cherry tree upward and it amounts to nothing; scrape it downward and 'twill kill a man." This he would apply when showing how a thing should be done and how it shouldn't. "This beats the Jews in Chatham street," he would say, when finding something particularly wonderful or incomprehensible; or if a supremely ridiculous correspondent was found among his pile of letters, he would exclaim, "In the language of Felix McConnell, this is a great country—the shrubbery is so delightful." His story of the "wool hat and leather breeches," and of the pigeon that "couldn't keep up," will always be remembered among the many quaint but interesting sayings of Mr. Patten. It is hard to realize that we shall hear them no more; that his voice is forever stilled, the busy pen is silent, the active body quiet. Harder and more sorrowful must it be for those bound to him by family ties. In his marital relations Mr. Patten was particularly blessed, and, irreparable as his loss may be regarded by friends and associates, the blow falls here with its most crushing weight. As a husband and father he was tender and true; his wife and a son survive him.

Thus we have come to the parting of the ways with one by whose side we have sat for the past three years. The journey has been pleasant, for his companionship was sweet, and his heart was genial and true. Others who knew him longer could give stronger testimony to his worth, but, such as it is, gratefully, reverently, with uncovered head, do we lay this small chaplet on his grave. SOL.

A NEW SAFETY-LAMP.

MR. JOHN WILLIAMSON, Hednesford, manager of the Cannock and Rugeley Colliery Company's works, has, after a long series of experiments, introduced to public notice a new safety-lamp, which appears to combine the meritorious features of former lamps, and to avoid their drawbacks. For instance, it is claimed for it that it is as safe as the Stephenson—the safety-lamp hitherto introduced, but objected to on account of its dim light—while it gives a better light than even the Clanny, and it is not easily extinguished when exposed to air traveling at a high velocity. The inventor believes that the firing of a shot, the closing of doors, or the fall of a roof is sufficient to cause the Davy, the Clanny, or the Mueseler lamp to explode when in use in an explosive mixture, but his own lamp has been subjected to severe tests both by himself and by engineers in the North of England, and in no case can it be made to explode. As a fireman's lamp it is stated to be invaluable, inasmuch as when it is approaching a body of gas the top or hole can be seen clearly, but if the lamp be plunged into a body of gas the light is extinguished before sufficient heat can be generated to do harm. In appearance the lamp is like the Clanny, the bottom, or oil vessel, and wick arrangement being the same. It contains two glass cylinders, an external one similar to the Clanny, and an internal one similar to the Stephenson, the latter being also capped with a copper or gauze cap, as in the Stephenson. The gauze in the lamp is similar to the Clanny, but without a cap. The improvement, as compared with the Clanny, consists in the arrangement of the inner ring, which in this lamp carries both glasses, and when screwed up presses the cap of the inner glass gently against the top of the gauze. The air passes through a perforated portion of the bottom part of the lamp, and through the gauze fixed on the periphery of the inner ring and on to the flame; and the lamp is described as really a double lamp, there being no danger even if the outer glass and gauze be stripped away, so long as the inner glass remains intact.—*Mining Journal.*

NEW COLOR PRINTING PROCESS.

IN ordinary color printing, it is known, as many plates or stones have to be used as there are varieties of color. M. Greth, of Zurich, has (according to the *Württ Gen. Bl.*) recently invented a process in which all the colors are printed at once with one stone. The colors used are fusible in heat. The most prominent color is first poured on a perfectly even marble plate, and the parts not to be covered with this color are cut out with a vertically held knife down to the surface of the stone. A second color is now poured in, and the parts not to be covered with it are cut out, and so on, till the colors required are complete. The thickness of the coloring mass is determined by the number of impressions (1 ctm. for 1,000), and after each impression the plate is raised about $\frac{1}{10}$ mm. The paper is moistened with turpentine, and the impressions may be made with nearly the same rapidity as impressions with one color only. The number of colors has a quite insignificant influence on the price of the prints, whereas the number of stones in the ordinary method raises the price enormously. M. Greth has produced pictures with 400 colors on one plate. The invention has been utilized in Paris for calico printing, and in Alsace for imitation of Persian shawls. We described this process substantially some time ago in the SCIENTIFIC AMERICAN.

MALACHITE GREEN.

THE Berlin Aniline Company (Actien Gesellschaft für Anilin Fabrikation) has introduced a new green color into the market, which, from its remarkable properties, seems calculated to play an important part in dyeing and printing.

Malachite green, the preparation of which has been patented in most countries by the company above mentioned, is formed by the action of benzotrichloride upon methyl-aniline in presence of metallic chlorides. The inventor of the new dye is Dr. O. Döbner, assistant of Professor A. W. Hofmann.

As the German patent is not completed, the process for the preparation of the dye cannot be published in detail. The green is not produced in a circuitous manner, involving the joint action of another aniline color, as in the case of methyl green, which may be regarded as a secondary product. It is formed directly by the action of the above-mentioned materials, and it is the sole product of the reaction. This makes its preparation much cheaper, and permits the color, notwithstanding its advantages, to be sold at a lower price than methyl green.

From this latter dye it is essentially distinguished by the circumstance that it bears heat without changing its color. It is well known that methyl green, if heated to 212° Fahr., turns to a violet. Hence it can only be used in dye baths at a moderate heat, and yarns and tissues dyed with it cannot be heated. Malachite green, on the contrary, is not affected by heat, and can be dyed in a boiling beck, and the goods in drying, etc., may be heated as high as required without danger.

The new color is used for dyeing silks, woolens, and cottons, exactly in the same manner as methyl green, from which it is favorably distinguished by its superior fastness and permanence as against acids, soap, and heat. The last point is especially important as regards its applications in printing.

The color can be dyed at a boil in a slightly acid flot, and therefore admits of the simultaneous application of picric acid and other colors of an acid character. Wool may be dyed with this color dark shades of green in one beck, with the addition of hyposulphite of soda and a mineral acid.

The wool does not require to be previously mordanted, a point of no small value in piece dyeing.

Even the darkest shades come up a pure green, while the darkest shades dyed with methyl green have a very decided blue tone.—*Reimann's Farber-Zeitung.*

PROGRESS IN VAT DYEING.

IN contrast to most other departments of the art, vat dyeing has not in recent times undergone any important improvements, and such as have been made have found but little favor with practical men. The sphere of the warm vat has remained almost untouched, and Messrs. Gutbier & Götze, of Leipzig, have been the first to bring forward here a novelty. Setting out with the hydrosulphite process, they have aimed at an improvement both of the cold and the warm vat.

The difficulty of preparing the solution of hydrosulphite and its ready decomposibility have deterred the majority of dyers from the application of this process, especially as far as the warm vat is concerned. Gutbier & Götze offer for sale a ready-made vat-liquor which, when added to any ordinary beck of water, forms at once a vat ready for use, and capable of being applied either to wool or to cotton, with this only distinction, that, in accordance with the nature of the fiber, the liquid is used hot for wool, but cold for cotton.

The advantages of the new system are:—

1. The cost of constructing the ordinary vats is done away with, as it is possible to dye in any ordinary beck.

2. In case of wool dyeing, the necessary heat may be applied either by direct fire or by steam, whether direct or indirect. It is well known that the ordinary warm vat cannot be worked with direct steam heat.

3. The lightest and the darkest shades can be dyed in the same vat, according to the quantity of reduced indigo added, thus effecting a great saving of time.

4. The management of the vat is so simple that it can be at once intrusted to any one. It never gets out of order or becomes sick. Hence a special foreman vat-dyer is no longer required.

5. The new process enables the indigo to be worked up almost to theoretical perfection.

The vat does not need to be always set afresh, but, like the ordinary vats, can be left covered up if it cannot be used in one day.

The "vat liquor" sold by Guthier and Götze is prepared with fine Bengal indigo. Those, however, who prefer to buy their own indigo can have the solution alone, with which the vat may be set on adding the necessary quantity of lime and indigo. It may be remarked that the best sorts give the most advantageous result.—*Reimann's Färber-Zeitung.*

BLEACHING WOOL.

KNAB and Fournier propose the following method of bleaching wool, and in general fibers and matters of animal origin, whether woven or not. They prepare a solution, in clean water, of oxalic acid and glycerine, and steep the wool to be bleached in this liquid. The operation is the more rapid the more oxalic acid is present in solution. As, moreover, glycerine and oxalic acid are soluble in water, they are easily removed after bleaching. To obtain a good result it is necessary that the water employed is pure, and, especially, does not contain salts of lime in solution, for the presence of these salts would give rise to the formation of insoluble oxalate of lime, which would coat the wool over with a superficial layer. Oxalic acid, combined with glycerine or employed alone, has the inconvenience, while bleaching wool, of felting it, if unspun or in slivers. The authors have succeeded in obviating this inconvenience by saturating the acid previously with potash, soda, or ammonia. The bleaching is effected in the same manner, but the wool retains its suppleness without felting or acquiring a harsh handle.

Raulin patents certain improvements in the mode of treating wool in all its forms applicable to all the operations in which it is acted upon chemically by liquids and gases with a view to its purification. The inventor remarks that there are in the woolen manufacture a number of processes mainly reducible to the three following:—Submitting the wool to the action of a gas, to that of a liquid, and draining it after it has been saturated with liquid. In these processes it is customary to work as if a mass of wool presented a great resistance to penetration by gases and liquids, and as if these gases and liquids likewise resisted considerably when it was attempted to extract them. This manner of operating requires much motive power, complicated and expensive machines, and considerable labor. A large part of the gases is generally lost without useful effect, and the wool, owing to all these manipulations, is unfavorably modified in its physical properties.

On the other hand, by turning to account the principles discovered by the author—which show that wool is readily permeable by liquids and gases, and may be easily freed from them under the influence of feeble forces, if only applied methodically—machinery may be simplified, chemicals, labor, and motive power may be saved, and the natural aspect of the wool may be preserved. The principles in question are the following:

1. Gaseous currents under a very slight pressure can easily traverse a thick layer of wool, even strongly compressed, so that the cubic meter holds 190 kilos. in place of 30.

2. Liquid currents can traverse a thick and compact layer of wool even under slight pressure.

3. A vertical column of wet wool becomes gradually free from its water, beginning at the top, and after some hours the upper part presents exactly the aspect and the capillarity of wool drained by a centrifugal machine.

To effect this drainage by capillarity it is merely requisite to leave the column of wet wool to itself for several hours, taking care to place beneath it, in contact with its lower surface, another mass of wool of a suitable thickness, which serves to aspirate the liquid from the upper mass.

COATING METALS WITH TIN.

THE brilliancy and cleanliness of tin have long kept it in great favor for culinary and various other purposes, and an invention of Messrs. Neuberg & Co., of Vienna, promises to make it still more readily applicable. They propose its electro-deposition by means of a zinc and carbon battery. The inner cell, containing the carbon, is half filled with chromic acid and the outer cell, containing the zinc, is filled with dilute sulphuric acid. The articles to be coated with tin are put into a bath composed of protochloride of tin and cream of tartar, with or without chloride of tin. The proportions of these ingredients are: eight parts of protochloride of tin, 16 parts of cream of tartar, and two parts of the chloride if the latter is used. When it is present the tin coating is effected more rapidly, whereas when the bath is composed of protochloride of tin and cream of tartar only the tin coating is very white, but is not produced so rapidly as when the chloride is used. These ingredients should be dissolved in about 100 gallons of distilled water. The black plates are first "pickled" in any suitable manner, and then immersed in the above described bath or solution, and are allowed to remain in the same for a longer or shorter time, according to the thickness of the deposit or coating of tin required on the plates. While in this bath the plates or other pieces to be coated are connected by a wire with the positive end of the battery, while the negative end of the battery is connected with a piece of tin hung in the same bath. When the plates or other pieces or articles have been sufficiently coated with tin they are held over a fire in order to give the tin a lustrous appearance.

CERULEINE AND GALLEINE.

THESE two coloring matters are manufactured on the large scale by the firm of Durand & Huguenin, of Bale. According to M. H. Koechlin, galleine produces in printing rose and violet shades, which resist soap very well. With a chrome mordant they give more saturated shades, and with oxide of iron they produce pretty grays. Ceruleine dyes an olive with mordants of iron and alumina; this is the first dye-ware which thus yields directly a green shade. It resists light and soap very well. It is very sparingly soluble in water, but it can be dissolved in water to which has been added bisulphite of soda at 1·39, equal in weight to that of the dye-ware. Probably, under these circumstances, there is formed ceruleine—a product of reduction.

HANDKERCHIEFS printed with chloride of cobalt are now sold under the name of "Foulards Barometre." The design represents a man with an umbrella. In fine weather the umbrella is blue; in changeable, gray; and in rainy weather, white. The first washing removes the chloride of cobalt, and the handkerchief loses its barometric properties.

BROWN ALIZARINE.

By M. PRUD'HOMME.

THIS color gives with mordants shades resembling those produced by the coloring matter described by the author a year ago. In printing fixed with prussiate, or with the acetate of chrome, it yields light shades varying from a mode to a gray. Heavy shades are difficult to obtain with this product.

Under the influence of alkaline oxidizing agents, brown alizarine gives a red liquor, which, on exposure to the air, becomes covered with a blue scum. By reason of these characters it appears identical either with the brown matter formerly described, or with that obtained by the alkaline reduction of nitroalizarine.

If, in fact, a solution of nitroalizarine in caustic soda is heated for a sufficient time in presence of salts of tin, or of hydrosulphite of soda, the color becomes successively violet, blue and red, and is covered with a blue scum. Of these reducing agents alkaline hydrosulphite seems the most advantageous.

This vat, which much resembles that of precipitated alizarine blue, deposits a brown body, which, when suitably purified, dyes like the "brown alizarine" from Ludwigshafen, but gives brighter shades.

This result may be due to the fact that a certain quantity of unconverted nitroalizarine exists in the commercial product.

In fine, this substance may be of importance for the producing of fast grays and olives, in place of such as are produced with the aid of albumen.—*Bulletin de la Soc. Ind. de Mulhouse.*

BLACK DYES.

G. WOLFF prepares black dyes and varnishes by dissolving 0·24 aniline-blue, 0·35 aniline-yellow, and 0·05 aniline-red in 16 alcohol. By the addition of castor oil, benzole, and more alcohol, the mass becomes suitable for dyeing leather black, while black varnish is obtained by the addition of shellac.

CONCRETE DE JAVELLE.

BROCHOCKI has patented the following bleaching composition, which he names "Concrete de Javelle." His object is to furnish the alkaline hypochlorites in a crystalline state in the form of granular salts, or compact blocks. This product, the bleaching power of which may rise as high as 150 chlorometric degrees, is obtained by submitting a very concentrated lye of caustic potash, or soda, to suitable refrigeration, and passing through it a current of gaseous chlorine, previously refrigerated and washed in cold water until the complete saturation of the lye, which is kept all the time at a low temperature. To augment the production, the mother liquors derived from former operations are utilized by submitting them to evaporation in a vacuum and then refrigerating them anew.

OBERNETTER'S REVERSED NEGATIVE PROCESS.

IN the *Mittheilungen* Herr Sigson says that, being only able to take portraits at one end of his studio, he used to feel annoyed at not being able to get proper companion pictures to hang (say) on each side of the fireplace, as both pictures would look the same way. He, however, got over the difficulty by stripping off one of the negatives and printing it with the wrong side uppermost. His *modus operandi* is as follows: The negative to be drawn off is retouched and varnished (Herr Sigson uses Schering's varnish much diluted with alcohol), and is then laid in water. As soon as the edges of the film begin to soften the negative should be taken out of the water and left to drip, and a piece of common writing-paper, which had previously been floated upon water, should be laid upon the negative and the superfluous water pressed out. The corner of the film should then be raised from the glass with a knife and drawn off along with the paper. If on raising up the corner the film should crackle, that is a proof that it is not sufficiently softened, and the whole, including the paper, should be returned to the vessel of water for a short time. Herr Sigson found that with the varnish he used the time the negative required to soak in the water varied from one and two hours with a thin varnish and clean plate to a whole day when the varnish was extremely thin, and sometimes it was even necessary to revarnish. When the varnish is glassy half an hour is generally sufficient to soften it, and care must be taken not to let it soak too long, or it will cause rents in the film. When the film has been drawn off another piece of writing-paper is moistened and laid upon a piece of glass, and the film is then laid upon it with the first paper uppermost; the whole is then pressed together and the first paper removed. A thin solution of gum arabic is now carried over a clean plate, and the same is passed over the upper side of the film, which is then laid upon the plate. The excess of gum is discharged by pressure and the paper removed, leaving a reversed negative. The rest of Herr Sigson's paper is occupied with directions for combination printing.

With regard to Obernetter's reversed negative process, the *Photographisches Wochenblatt* says:

"Repeated careful experiments have convinced us that the prescribed proportion of silver (namely, five grammes to 400 c.c. raw collodion) is insufficient. The film got with it is too thin. We added eight grammes of nitrate of silver and were not then satisfied, and only when we used ten grammes could we get a film with any body. Further, it is important to keep this silver collodion in the dark, as the light affects it. Then it seemed that the nitrate of silver was far from being as equally distributed in the collodion as the bromine and iodine salts, the first plates being really cloud negatives with more or less opaque spots. We have, therefore, tried shaking up the silver collodion when preparing it with our whole strength, and then letting it stand to settle. This operation repeated for several days at length produced the desired result.

"According to our observations, the potassic bromine bath is the one best suited for dry plates. We take—

Raw collodion	1 pound,
Nitrate of silver	10 to 12 grammes,

and sensitize in a bath of—

Distilled water	1 kilogramme.
Bromide of potassium	120 grammes.

Then we rinse both sides of the plate carefully with common water, let it drip, and then coat it twice with a ten per cent. tannin solution. In spite of the comparative insensibility of bromide of silver films coated with bromide of potassium solution, we should by no means advise any one to wash them by ordinary daylight, as that tends to render them insensitive and foggy.

"We develop as follows: When the plate has been exposed we pour over it the ordinary mixture of water and alcohol and then wash on the tannin solution, though it should be said that Obernetter's way of first coating the plate with a weak solution of nitrate of silver gives still better results. We coat the plate then with a three per cent. silver solution, followed by a one to fifty solution of pyrogallic acid in water with a small addition of alcohol as developer, and get the best results. We also tried the alkaline developer, and found it possessed no advantage; it was also very disagreeable to work with. Damry's developer also gave very good plates, and the developer he recommends proved usable.

"We found Obernetter's dry plates (developed with pyrogallic acid) specially worthy of recommendation for enlargements, as they reproduced all the details, even in the shadows, without being too dense for artificial light—that of the sciopticon, for instance—to pass through them."—*Brit. Jour. of Photo.*

TRANSPARENCIES FOR WINDOW ORNAMENTATION.

PHOTOGRAPHERS being sometimes called upon to provide transparencies for the ornamentation of glass doors or windows in domestic architecture, a few remarks on this application of the results of our art-science may be useful; but such observations as we have to make must be considered as merely suggestive, and not by any means as exhaustive.

There are certain principles which we would lay down as a basis for this application of our art, the first of these being that the window or door pane to be ornamented must have its transparency destroyed, by which is meant that it must be so treated as to render it impossible to be seen through. The general function of an ornamented window is to prevent an unpleasant or inartistic scene outside from being perceived by those inside; and it is well known to some of our readers that one of the largest and finest windows of the kind we are describing intercepts and blocks out by such artistic means the view of a coach-house and stable with their accompanying stable-yard. Those whom we have captivated by this choice specimen of the united work of the photographer and the painter had no conception of the fact that as a background to this work of art, although unseen by the spectator, the unpleasant erections named stand at a distance of thirty feet. A second principle that should be recognized is that of having the picture of a vignetted, sketchy character. The tone, unless when the nature of the subject otherwise demands it, should be warm and "sunshiny."

There are three mediums which may be made use of as the bases upon which to print the transparency, namely, paper, opal and ground glass. It is very fortunate that the first is at once the best, the easiest, the cheapest, and most convenient of these various bases. But if the image is to be formed upon it by silver printing a method quite different from that employed in ordinary practice must be made use of; for, whereas in an ordinary photograph it is essential that the image be on the surface, it is here one of the conditions of success that it be sunk into and distributed through the entire substance of the paper. The difference between these two conditions may be easily exemplified by dividing a sensitive sheet of albumenized paper into two, and printing one of them with the albumen surface, and the other with the back of the paper, next to the negative, the printing being carried out in the second case until the image is clearly visible upon the albumen. Now examine the two prints as transparencies, and it will be seen how much more vigorous is the one than the other. To prepare paper for transparency printing it should be immersed in and not merely floated upon the silver bath. Several very fine window transparencies we have seen are made upon plain salted paper.

There does not appear to be any special condition required in the selection of paper for this purpose beyond this —that it must be wove and not wire-laid paper. Plain, unalbumenized Saxe or Rives papers answer admirably, and the only preparation required is a primary immersion in a ten grain solution of chloride of sodium, followed, after drying, by immersion in a thirty or forty grain solution of nitrate of silver. The printing must be carried to a great degree of depth to allow of the reduction that will ensue upon the fixing; for the gold toning will be so slight as not to interpose any great obstacle to the solvent action of the hyposulphite of soda upon the silver of which the print is composed. It will be borne in mind that what we are now aiming at is the production of a very deep, warm-colored transparency.

This having been obtained, the next step is to render it transparent and attach it to the window pane. It will be understood that the degree of transparency to which the print will be amenable falls far short of that by which objects at a distance can be perceived through the pictorially-ornamented glass; in short, it is the transparence or, more correctly, the *translucence* of ground glass or of pot opal that is required. To such end provide a rather weak solution of Canada balsam in benzole, and apply this repeatedly to the picture until the transparency acquired by the first touch of the varnish brush, and which disappears upon the evaporation of the benzole, becomes permanent. Three or four applications of the varnish may be required ere this be attained.

The glass plate, having been cleaned, is coated with the same varnish, which, for this purpose, should be strengthened by the addition of more balsam; and a similar coating having been given to that side of the print that is to be placed in contact with it, an attachment is made, commencing at the foot, and keeping the upper portion of the print curved outward so as to admit of a continuous layer of the liquid varnish remaining at the point of junction between the paper and the glass, until the two are brought into contact up to the top. This insures the avoidance of air-bubbles, which, although they may be rubbed out, are yet better avoided. When the whole has become thoroughly dry the services of the artist may be utilized to examine the whole critically, and complete the effect by imparting a little more depth here and there as may appear necessary.

A friends of ours, having a cultivated photographic taste, became the fortunate possessor of a yacht in which were a pair of folding doors with ground plate-glass panes of large dimensions, having a very handsome border, embodying a floral design surrounding each. The center was adorned with the arms of a previous possessor, for whom the vessel had been constructed. Both the ornate border and the arms were deeply engraved by means of fluoric acid, which, when applied as a fluid, causes the surface acted upon to be of a glossy, smooth texture compared with the matt surface that results from effecting the etching or engraving by fluoric acid *gas*. What was required was the means of removing the arms, leaving the *entourage* intact. This has been effectively accomplished by covering the former with a photographic

paper transparency, prepared, as we have described, with the additional element of colors, the transparent oil colors employed having been those found most effective in the coloring of lantern slides, namely, Prussian blue, gamboge, burnt and raw sienna, with madder and carmine for the reds. By means of these colors every combination of tint may be made. The pictures prepared in this manner possess a very fine appearance, no trace of the still existing arms being visible. It will be understood that although we have described in detail the method of printing by silver, pigmented tissue may be made use of with equal facility and with the further advantage of permanence.—*British Journal of Photography.*

PHOTOGRAPHING A TROTTING HORSE.

WE had the pleasure of witnessing on June 15 the successful accomplishment of a feat in photography which has never been excelled, and which marks an era in the art, viz., taking a series of photographs of a trotting horse while at full speed, so as to illustrate the stride. A series of experiments with this end in view have been made by Muybridge, the photographer, at the instance of Gov. Leland Stanford, and the trial on that day showed how perfectly the work could be done. The experiments have been conducted at El Palo Alto farm, Menlo Park, where Gov. Stanford has established a stock farm for breeding thoroughbred horses, and where there is a fine track over which the horses could be sped.

Some five years ago Gov. Stanford asked Muybridge if it were possible to take a photograph of a trotting horse at full speed, but at that time it was considered impossible. About a year since, however, the experiment was tried and a photograph of "Occident" was taken while the horse was traveling 36 feet per second. It was a single picture, however, and excited more ridicule than praise, as most people thought the whole thing a humbug, not believing it possible for the picture to be taken, and not believing the position of the horse to be natural. This initiatory attempt has been followed up, however, until on Saturday last a series of 12 pictures were taken in less than half a second, while the horse was traveling 40 feet per second. These pictures illustrate the stride of the trotter precisely, and although they upset many preconceived theories and opinions, may be regarded as decisive. The method of taking the pictures is by no means complicated, and when once understood will be seen to be perfect, but several different ways were tried before a successful one was found.

On one side of the track a large screen is placed, and set at an angle of about 20 degrees from the perpendicular, the screen being covered with white cloth and having vertical lines formed across it 21 inches apart, which show black against the white cloth. The spaces between these lines are numbered from one to twenty in conspicuous black figures at the top. At the bottom is another low white screen with horizontal lines 4 inches apart to show the height of the horse's feet above the ground. Powdered lime was sifted over the track in front of the screen so as make a perfectly smooth, white surface, over which the horse was driven. On the opposite side of the track from the screen a low shed was erected, open in front, and on a bench or table were placed 12 cameras, numbered in order, so as to take 12 views 21 inches apart. These cameras were of English manufacture and constructed with an improved double slide, so that the exposure could be cut off instantly, one slide moving each way across the lens. The slides were held open by a catch connected with an armature in the side of the camera. A battery of eight jars was placed in the shed and each camera had an independent set of wires. These wires were led across the track under the ground until within two feet of the background or screen, where they were raised so that one of the sulky wheels would pass over and strike them. The wires corresponded with the vertical lines on the background, and as the sulky wheel passed over the wires the armature holding the catch of each separate instrument released the catch and the slides cut off the exposure of the camera at the instant, so that the photograph was taken without any blur. As the wheel passed over the different wires the different pictures were taken, each 21 inches apart, illustrating perfectly the stride of the horse.

The trotter "Abe Edgington" was brought out on Saturday, and after being warmed up a little over the track, after the apparatus was all ready he was put to a 2:20 speed past the screen. He came down the track in splendid style, with a good, square motion and firm trot. As soon as the wheel struck wire No. 1, camera No. 1 was closed by the means described, and the first picture taken; when it struck No. 2 the second camera had the second picture, and so on until 12 pictures were taken 21 inches apart. The arrangement insured accuracy which was unquestioned. The horse was traveling about 40 feet per second, and there were 12 distinct and separate pictures taken in a space of 21 feet, each in an appreciable part of a second. The sound of the slides closing was like a continuous roll, so quickly was the feat accomplished. The negatives were perfect, without any signs of blur or indistinctness.

It would be impossible to describe the various positions of the horse's feet at different points of the stride, but there are positions which one would scarcely imagine, but which could not be questioned by those who witnessed the operation. At one point all four feet are off the ground, the two nearest being eight inches above it. Some of the positions are very curious, indeed, but one needs to see the photographs to appreciate them. Muybridge intends to mount the whole 12 on one card on a small scale, so that any one can procure them at Morse's gallery.

In photographing a running horse the wires could not be used in the same way for manifest reasons. Fine black threads were placed across the track, 21 inches apart, and connected so that the armatures would release the slides as before. The racing mare "Sallie Gardner," a handsome animal, was brought out and the threads placed so as to strike her breast as she went by. The instruments were made ready, the signal given, and she came rushing down the track like a whirlwind. As the threads successively, by the means described, released the catches and closed the slides, the 12 pictures of the running horse were taken. When the mare broke the eighth or ninth thread she became aware of something across her breast, and gave a wild bound in the air, breaking the saddle girth as she left the ground. This gave a curious picture of the mare with her legs wildly spread and the broken girth swinging in the air just as it is separating. This series of pictures are also very interesting, but difficult of description. They show, however, the gait of the running horse exactly, and in a manner before impossible. A long description even would be unintelligible, while the photographs show the whole stride at a glance.

With the trotting horse the motion of each foot can be followed throughout the stride, and accurate measurements taken by the aid of the vertical and horizontal lines. It is curious to notice that the propelling power of the horse seems all in the hind legs, while the front ones seem only used to support the body. Another curious feature noticed was that the sulky was only on the ground about half the time. The ground was perfectly smooth and even, having been carefully rolled, and the powdered lime sifted on gave an excellent surface for observation. The track made by the wheels show they were moving in short bounds, as if the spring of the felly between the spokes threw the wheel off the ground at the spokes. The wheel would make a mark for about six inches, and then none for about four inches, and so on with considerable regularity.

Gov. Stanford has gone to considerable trouble and expense in having these experiments conducted so thoroughly, and Mr. Muybridge, who is an enthusiast in his art, has carried them out skillfully. The electrical portion of the appliances were made in this city by the San Francisco Telegraph Supply Company. The results are highly satisfactory, and cannot be caviled at. Quite a number of gentlemen witnessed the experiments, among them representatives of the principal daily and weekly papers, and quite a number who make turf matters a specialty. The application of electricity as an adjunct to the camera was perfectly satisfactory in every respect, and the pictures were as accurate as possible. The series of photographs will be of great interest to all having any interest in horses, as they show conclusively how the stride is accomplished at high speed, a subject on which there has been a wide difference of opinion. These pictures, however, settle the matter conclusively, and many will have to give up their ancient prejudices.

We would like, did space permit, to give some description of Gov. Stanford's magnificent place, but it would require several columns to give even an idea of it. The ranch is a short distance from Menlo Park Station, on the S. P. R. R. Around the residence are highly-cultivated and ornamental grounds, kept in the neatest order possible, with handsome large stables for the house-horses and carriages, numerous outbuildings, etc. Smooth gravel roads and paths run in all directions, and there is a pleasant mile drive up to the large stables where the fancy stock are kept. Here is a very large, handsome stable, where "Occident" and several more valuable animals are kept, each in a fine box-stall by himself, with all the stable appliances necessary for comfort and health. Extending around this stable on two sides is a long row of low buildings, divided into box-stalls, for other blooded stock. Fields near by are divided up, so as to leave pastures for the yearlings, the mares with and without colts, etc. There are also a group of buildings for the trainers, grooms, hostlers, etc. A handsomely laid-out track passes near by the stables, on which the horses are exercised and trained. The Governor has over 200 head of blooded stock. The horses were all brought out on the occasion of our visit and showed careful grooming and good care. They are all, without exception, thoroughbred, and some of them cost pretty long prices. The Governor's idea is that this climate is the best in the world for breeding thoroughbred horses, and he has procured the best he could find to breed from, being satisfied that the coming trotter will be a native of California.—*Mining and Scientific Press.*

PAPER NEGATIVES.

IN the *Bulletin de l'Association Belge*, M. Laoureux describes a method of substituting paper for glass in taking negatives. The waxed paper, as in the usual process, is overlaid with talc, and then coated with collodion like an ordinary glass plate. It is exposed in the camera by means of the slides ordinarily used in the paper process; then, having been treated as an ordinary negative, it is placed, while still wet, on a plate, slightly warmed, and covered with a mixture of glycerine and gelatine. The pellicle bearing the negative detaches itself easily of its own accord. The gelatine solution recommended by M. Laoureux is composed of—

Gelatine	20 parts.
Water	100 "
Glycerine	2 to 4 "

THE RICHMOND (MO.) CYCLONE.

ON Saturday, June 1, one of the most violent, destructive, and fatal tornadoes ever experienced in this country passed over the central portion of Ray county, about thirty-five miles east of this city, striking the town of Richmond, destroying over one hundred buildings, killing outright thirteen persons, and more or less seriously wounding more than seventy others.

To the Kansas City *Journal*, which dispatched a messenger to the scene of the storm, we are indebted for the following interesting particulars: "We learn from Mr. Casey, deputy postmaster at Missouri City, that the cyclone gathered near that place between two and three o'clock. The steamer Fanny Lewis had left the landing, and was about a mile and a half down the river, when she was entirely hidden from view by a dense, muddy looking, funnel-shaped cloud which passed near her and close to the water. This cloud then raised and passed to the right of the town, and at the same time another cloud of a like description passed to the left, the distance between the two being estimated at about two miles. As they swept in a northeast direction they made a noise resembling the running of a heavy freight train, and attracted general attention. Far off in the distance they appeared to unite in one immense cloud, and descend toward the earth. The day had been intensely sultry, and when the clouds were passing Missouri City, great drops of rain were falling; and such had been the character of the weather throughout the day.

"When it reached Richmond Mr. David Whitmer was standing in the back door of his stable, and says that two dense, black, funnel-shaped clouds appeared to unite in one, and to come onward, with the small end of the funnel down This appeared to act as a sucker for the vacuum of the funnel, and would draw all objects in its path upward with a sifting motion and then scatter them broadcast over the ground. It would draw a house up from the earth, and shake it back and forth like the vibrating sieve in a fanning mill, carrying the lighter portions up into the funnel, and letting the heavier ones fall. It moved slowly—slow enough, some say, for a man to have escaped from its track. It appeared that whenever the vacuum in the funnel became filled or overcharged, the cloud would burst, and then buildings would be swept clear to their foundations, and the ground swept as clean as if by a broom. Then it would belch forth its contents of debris, timbers, mud, water, looking, as eye witnesses report, like a building on fire, surcharged with flame and smoke. This characteristic appears to account for the almost wonderful preservation of lives and property in some instances, while all around was scattered dire destruction."

It entered the city first on the track of the cyclone of eight years ago, and came far enough down to pay its respects to the *Conservator* printing office of Mr. Jacob Childs, from which it lifted a portion of the roof; it then hung in that vicinity for several seconds, when it took the back track, paying its respects to the roof of the savings bank, and departed again to the south, where it united with the cloud as seen by Mr. Whitmer. After striking the residence of William Jackson, on the hill in the southern suburbs, which it destroyed, it mowed a swath three hundred yards wide to the extreme northern limits of the city, clearing from the ground every vestige of improvement, leveling the strongest buildings to their foundations, and carrying the composing materials of their construction in its deadly grasp far away. In some instances it went beneath the foundations of strong two and three story buildings and dug out heavy sills, eighteen inches square and sixteen feet long, and carried them beyond human knowledge. The wonder is now, in looking over the ground, not that so many were killed and injured, but that any escaped. War, in all its terror, never wrought destruction such as is here visible on every hand. The human mind is too weak to grasp the picture, much less to paint it in words. Great trees were torn up by the roots and hurled rods away, others stripped of every leaf and twisted off near the ground (and in every instance against the sun, or from the west to the east). From the ground to the topmost twig others are entirely stripped of bark and branch—shaved as clean as a whistle.

In the old cemetery there probably is to be seen the most impressive evidence of the force and power of the cyclone. It occupies about an acre and a half of ground, was thickly studded with stones and monuments, and shaded by a heavy growth of locust trees, many of them eighteen inches through. Four-fifths of those trees were twisted off eight or ten feet from the ground, or even uprooted, and the few that remain standing have been stripped of bark from the roots to the topmost twig. Every stone and monument is overthrown or broken off and the ground is pulverized and grass scorched as if burnt by a cloud of fire.

All day Monday and Tuesday the owners of private residences were in many instances engaged in searching in the vicinity of their once homes for household relics, only too rarely found. In a few cases the house had been swept from the sills, leaving the boards of the ground floor in place covered by the carpets, and these were being removed. In one house there remained a piano, in another a bureau, each only slightly injured, the latter being of special interest in having preserved the life of a mother and child who were prostrated in front of it when the house was swept away, and a mass of falling timbers that were dashed downward found support in its unyielding strength, and the mother and child protection at its base, while a few feet away another woman, an inmate of the same room, was crushed to death. The post office was entirely swept away, not a plank of it being left in place. The mails were scattered to the winds, and some have since been returned from a distance of twelve miles. The stamps, moneys, books and accounts were all lost.

The reporter of the *Journal* gives a number of incidents and facts which bear on the theory of these mysterious phenomena, and which seem to bear against the wind theory as the destructive element. The other theory is electricity—or in other words that the objects on the surface are lifted by electric force into the cloud, instead of being blown by a moving wind. The cloud is like the pole of a battery positively charged, and the earth a pole negatively charged. Now place a bar of iron or any conducting substance across and touching the two poles, and the equilibrium is restored. The theory in this case is that the houses, trees, and movable objects taken up are the conducting media, and as soon as the equilibrium is restored they are dropped to the earth again.

In the incidents related by the reporter, this theory seems to be generally and as a rule sustained. The objects taken up are not blown in advance of the storm, but are invariably shot upward into the interior of the funnel-shaped cloud and dropped from the more expanded mass above. If it was wind they could not be dropped. Then we find a roof lifted and set to one side and the building below the roof uninjured. This cannot be from even wind moving in a circle without lifting power at the same time. Again, trees are sometimes torn up by roots and carried up and let down. A wind with only forward or horizontal force would have prostrated the tree simply. In other instances trees are left standing but stripped of bark entirely even to the twigs, which are otherwise intact. This cannot be the effect of wind in any of its movements or in any direction of its force—it must be another force. And as electricity must pervade the body of the tree acting outwardly, the denuding of the bark is in harmony with this action. And finally we have instances where it went below the surface down to the foundations, and tore from their beds masses of timber sills eighteen inches square and sixteen feet long. This could not be mere wind moving horizontally. We next have the bounding movement of the cloud, coming to the earth, taking up a mass of material, dropping it, and rising into the air again, and coming down at other points. Is not this the result of differing states of equilibrium, exhausting its power, and when discharged of it, accumulating more from the surrounding conditions? It touched as many as six places in Ray and Carroll, bounding from two to four miles at a time.

It was also attended by a great development of heat, the grass and trees having the appearance of being scorched, and the cloud emitting volumes like black smoke. We have no direct testimony in this case as to actual flame, although this is not an uncommon phenomenon. This is of course electrical, and strongly supports the theory we have been considering. The roaring noise could not be the result of motion alone, for it was louder than even thunder, and it was moving at times no faster than a man could walk. This must have come from intense internal action.

Finally, we have its motion in the direction opposite to that of the hands of a watch. The movement seems to have been on a straight line on the southern edge of the cyclone—that is, the track of destruction makes a straight line on the southern edge of the storm track, while on the northern edge it is uneven. For example, a house on the north edge is totally destroyed while another in a direct line with it is untouched; then another swept clean, and beyond it a house unscathed. We cannot describe it better than to lay a cord down on the floor with loops in it at intervals. The loops represent the points of destruction, and the intervals where no damage was done. This is one of the most remarkable instances we have ever known in the history of the cyclone, and we have no doubt but this Richmond tornado will, from its destructive power, the slowness of its movement and the length of time it was observed, become one of the most noted for its scientific value.—*Western Review.*

A NEW CRATER ON THE LUNAR SURFACE.

WHEN examining the surface of the moon on May 27, 1877, Dr. Hermann J. Klein, of Köln, observed, with his 5¼-inch dialyte by Plössl, a great black crater on the Mare Vaporum, and a little to the northwest of the well-known crater Hyginus. He describes the crater as being nearly as large as Hyginus, or about three miles in diameter, and being deep and full of shadow, and as forming a conspicuous object on the dark gray Mare Vaporum. Having frequently observed this region during the last twelve years, Dr. Klein felt certain that no such crater existed in this region at the time of his previous observations. Dr. Klein communicated his observations to Dr. Schmidt, of Athens, the veteran selenographer, who assured him that this crater was absent from all his numerous drawings of this part of the lunar surface; neither is it shown by Schroter, Lohrmann, nor Mädler, who carefully drew this region with the fine refractor at Dorpat. On one or two subsequent occasions Dr. Klein obtained further observations of this new crater. He found it to be either without a wall or with a very low one, but to be a deep conical depression in the surface. Shortly after sunrise the crater takes the appearance of a dark gray spot, with an ill-defined edge.

In April, 1878, Dr. Klein communicated his observations to the editor of the *Selenographical Journal*, who at once took the proper steps to have this object observed by the members of the Selenographical Society. The day for observing this region was unfortunately cloudy, and no observations could be made in England, but Mr. J. Ward, of Belfast, caught a glimpse of the moon through a temporary break in the clouds. He at once saw the crater in the position assigned to it by Dr. Klein, and described it as being a black crater with a soft edge. The next opportunity for observing this crater was May 9, but the occasion was not favorable, the sun being then high above the horizon of this part of the moon. The day turned out cloudy. Messrs. Backhouse and Neison observed through thin clouds, and saw in the position of the new crater a dark elliptical spot. On May 11 Messrs. Knott, Neison, and Sadler observed in this place a dark ovoid mark or shading. So far, then, the English observations have been perfectly in accord with those of Dr. Klein, although bad weather has rendered it impossible to see the new crater as a crater.

Mr. Neison repeatedly examined and drew this portion of the lunar surface during the years 1871–1875, and discovered a number of minute details in the region where Dr. Klein has seen the new crater. Quite close to this object are a number of much smaller craters, several under a mile in diameter. Several of these are shown by Schroter, Lohrmann, Mädler, and Schmidt. It may be regarded, therefore, as absolutely certain that previous to 1876 there did not exist on this portion of the lunar surface a deep black crater of three miles in diameter, and it is thus Dr. Klein describes the new object seen by him. Mr. Neison has expressed the opinion that it is most improbable that he could have missed seeing so conspicuous an object as the present dark marking which it is certain exists now in this region. If, therefore, the existence of Dr. Klein's new crater be confirmed, it will form the strongest possible evidence of a real change on the surface of the moon, a change, moreover, of a volcanic nature.

The Mare Vaporum in which the new crater is situated lies close to the center of the visible surface of the moon, so that objects in this region are very slightly affected by the lunar librations. Fortunately it is a portion of the surface which has been most carefully studied by Lohrmann, Mädler, Schmidt, and Neison; for had this new crater of Dr. Klein appeared in a less well-known region, much doubt would have been felt as to whether it had previously existed or not.—*Nature.*

THE ELECTRIC LIGHT.

ONE of Philadelphia's largest carpet manufactories has recently put in the electric light to illuminate its floors, and the device is a complete success. It consists of a Brush dynamo-electric machine of 12,000 candle power, arranged to give four separate currents, each running an electric lamp of 3,000 candle power. Two of the lamps were placed on the third floor and two on the fourth floor of the immense building, and when the engine was started up the machine started at the same time, and without the slightest manual interference the lamps dashed out their light in all its magnificence. The effect was most brilliant. The rooms were flooded with a pure white light like the light of the sun, and it streamed out at all the windows, illuminating houses and streets for a long distance in every direction. The light was very uniform and steady, free from the flickering, and considering the enormous illuminating power, the light was unexpectedly soft and endurable to the eyes. Estimates were made as to the amount that the light furnished by this apparatus would cost if used by the carpet company as it was used on this occasion, and it was ascertained that the total cost of the whole light from the four lamps, including the items of consumption of carbon in the lamps, interest on the investment, and wear and tear, would not exceed thirty cents an hour. The light produced was photometrically equal to 800 gas-burners, burning five feet of gas per hour each. This amount of gas would cost $8 per hour.

NEW ELECTRIC LAMP.

By M. EM. REYNIER.

THE new electric lamp depends on the following principle: If a slender rod of carbon, pressed laterally by an elastic contact, and impelled axially against a fixed point of contact, is traversed between these two contacts by a sufficiently energetic current, it becomes incandescent in this portion, and burns tapering away toward the end. In proportion as the consumption of the end proceeds, the rod being continually propelled moves forward, so as still to abut against the fixed contact. The heat developed by the passage of the current is greatly increased by the combustion of the carbon. The model submitted to the French Academy gave a clear white light with four Bunsen elements. With more powerful electric sources many lamps may thus be worked.

THE INDUCTOPHONE.

THE inductophone is the name given by Mr. A. J. C. Adams to an apparatus for increasing the volume of the sounds received from a telephone through an induction coil and battery. Two disks of tinfoil connected to one end of the secondary coil, and separated by a third connected to the other end, nearly doubled the sound. Further experiments led to the conclusion that true telephonic sounds are based on Farnday's diamagnetism.

NERVOUS EXHAUSTION.

By GEORGE M. BEARD, M.D., Fellow of the New York Academy of Medicine, Member of the American Neurological Association, etc.

UNDER the term *Neurasthenia* (νεῦρον, nerve; α, privative; and σθένος, strength—lack of nerve strength), I described a number of years ago a functional nervous disease of modern, and largely, though not entirely, of American origin. It is a malady that has developed mainly during the last half century, although scattering cases appeared before that time. At present, in the northern part of this country, this disorder is exceedingly frequent, and is the cause of much distress; and yet, like many other important and interesting phenomena of the nervous system, it has been neglected by the profession, and abandoned utterly to tenth-rate popular medical treatises and the advertisements of charlatans.

Neurasthenia—poverty of nerve force—is to be distinguished from simple anæmia—poverty of blood—with which it is frequently combined; and also from hysteria, to which it often leads. One may be nervously exhausted without being anæmic. Some of the worst sufferers are full-blooded and fleshy, and of considerable muscular development; indeed, some of our noted athletes have been afflicted in this way.

Neurasthenia is also to be distinguished from the numerous organic diseases with which it is so often, though not necessarily, associated. It is a type of a very numerous class of functional nervous diseases—that is, diseases the pathology of which cannot be directly studied by the senses, but must be reasoned out deductively. The nervously exhausted state may, indeed, both follow and precede numerous other maladies, not only of the nervous system, but of special organs, and may accompany other diseases; but it is none the less a disorder of itself, and has an array of symptoms peculiar to itself.

Electricity in the general and central methods of application is one of the very best of remedies for this form of nervous disease; consequently, the cases, so to speak, drift toward those who use this method of treatment. From the first year of my practice I have seen this class of cases, and treated them, and, as the course of treatment is usually somewhat protracted—at least requiring a number of visits—the opportunity afforded me for the investigation of the symptoms and course of the malady in different varieties of constitutions has been universally good.

I soon found that the literature of this disease was of little worth—in fact, that it had little or no literature at all.* In order, therefore, to learn its nature and its symptoms, it was necessary to study the cases by themselves, taking notes of their histories and progress, with no other guidance than that obtained from my own preceding observations of similar cases, and occasional hints from physicians with whom I saw the patients in consultation, or by whom they were referred to me.

Some of the symptoms that I shall here describe are somewhat familiar to all medical men everywhere; others are familiar only to those who give their time chiefly to the nervous system; and others still are here described for the first time. Some of these symptoms are of such a positive character, and so frequent, as well as peculiar, that they give names to diseases, and for convenience sake are spoken of as diseases, although they are but manifestations of the neurasthenia. I present the symptoms without regard to logical order.

Tenderness of the Scalp.—This is a phenomenon of *cerebral irritation* (*Cerebrò-asthenia*) which is to the head what spinal irritation is to the spine. As in spinal irritation, the whole spine may be tender all the way from the first cervical vertebra to the coccyx, or the tenderness may be confined to the middle dorsal and middle lumbar vertebræ, so in cerebral irritation there may be tenderness over the entire scalp, or it may be confined to the vertex or to certain points in the forehead. Sometimes the scalp is so tender that brushing the hair causes pain; even touching the tips of the hair is disagreeable. At the vertex the tenderness is sometimes accompanied by a feeling of heat and burning, that may be somewhat relieved by firm pressure. This cerebral tenderness, like spinal tenderness, is superficial and peripheral, not deep-seated nor central, as some have supposed. It is the tenderness of the ramifications of the occipital and other nerves that supply the scalp, just as spinal irritation is tenderness of the superficial nerves of the bones of the spinal column.

A frequent spot of tenderness is found over the eyebrow and in the left temple. This is found in sick headache, and in connection with it there may be tenderness of the nape of the neck. A sudden jar, as when one slips in going down stairs, may, in these cases of cerebral irritation, cause temporary pain, as though the head itself had been struck. Emotional disturbance of any sort may bring on an attack of this symptom, as also may confinement in heated rooms, or in bad air, or over mental labor. These symptoms, indeed, are not constant, but come and go according to the exciting causes. Sometimes they last but for an hour or two, or for a day or part of a day. The same is true of all analogous states, spinal tenderness and general hyperæsthesia.

Tenderness of the Spine (Spinal Irritation, Myelasthenia) and of the Whole Body.—When the spine is so tender as to become an important and permanent affliction, and to overshadow other symptoms of the neurasthenic state, it is called spinal irritation; but strictly it is a symptom like cerebral irritation, not properly a disease as such, although, as a matter of convenience, there can be no harm practically in describing it as a disease. In regard to this symptom of nervous exhaustion these points are noticeable: First, its great frequency in the higher classes, especially among women. I suppose if one should go through Fifth Avenue, of New York city, and examine the spines of all the ladies between fifteen and forty-five years of age, he would find in quite a percentage of cases that at times there would be tenderness either of the whole length of the spine, or, more likely, at certain points, as the nape of the neck and between the shoulder blades and on the middle lumbar vertebræ. This condition would be found at times in those who do not call themselves invalids, and who are not under medical treatment. It would furthermore be found that with some of these cases there would be tenderness of the scapula or hip bones, of the breast bone, and, indeed, of the whole surface of the body. This general hyperæsthesia, like the local hyperæsthesia of the spine, appears and disappears under any subjective or objective exciting causes, and is attended usually by a feeling of debility, and oftentimes, though not always, by backache, headache, insomnia and mental depression.

The transient nature of this symptom of spinal and general irritation is shown by the fact that it may disappear often on application of electricity. Many women always have spinal irritation during the period of menstruation.

General or Local Itching.—Itching occurring without any visible change in the appearance of the skin is a common experience; but is not regarded as pathological, unless it be quite severe and persistent. In certain nervous states it becomes an element of positive distress. Itching of the scalp sometimes immediately follows any prolonged and exhausting intellectual exertion. I know a man who was once troubled with a general prickly feeling all over the body, and was sufficiently annoyed thereby to take treatment for it. Certain regions of the face, arms and legs may be the local seats of itching, which varies with the general condition of the nervous system. A lady patient of mine, of neurotic inheritance and temperament, was liable to terrible attacks of itching on a limited region of the arm; which attacks followed quickly, almost instantly, after nervous disturbance, and were not accompanied by the appearance of prurigo.

Abnormalities of the Secretions.—In nervous exhaustion the eyes may become moistened more readily than in health, and under a very slight emotion of pleasure or of pain. The flood-gates seem, as it were, to stand ajar, and on trifling agitation the tears flow forth. In grave cerebral disease this symptom is common enough, but in functional disease—simple nervous exhaustion—it is even more common.

In nervous debility, also, the sebaceous glands may refuse to do their duty; the hair and beard become dry and stiff, and much pomade is needed. The hair then falls off or becomes gray in patches. Dryness of the skin in this state is a symptom familiar to all; likewise is excessive and morbid perspiration in the axilla or in the hands or feet, or other parts of the body. Clamminess of the hands is, in young men, almost diagnostic of sexual exhaustion. In this state, also, there may be a suppression of the spermatic secretion—so that desire and power are wanting; with the improvement in nervous vigor, the secretion reappears. Likewise frequent and obstinate constipation of the nervously exhausted is oftentimes a result of suppressed intestinal secretion.

Tenderness of the Teeth and Gums.—Attacks of tenderness of all the teeth, accompanied by a whitish appearance of the gums, I have noticed in nervous exhaustion. In these attacks, which may result from over-work or excess, all the teeth may be very tender on pressure, although none of them are decayed. Here, then, is another opportunity to study with the naked eye the pathology of spinal irritation. In nervous exhaustion, whether complicated with anæmia or not, there may be tenderness of any part of the body or of the whole body. Tenderness of the head is cerebral irritation; of the spine, spinal irritation; of the tip of the spine, coccodynia; of the breast, irritable mammæ; of the ovaries, irritable ovaries; of the teeth, here described, dental irritation; of the womb, uterine irritation; of the stomach, nervous dyspepsia; of the heart, irritable heart; of the eyes, neurasthenic asthenopia; of the whole surface of the body, general hyperæsthesia: and all these various symptoms and expressions, without doubt, have a common pathology in nervous exhaustion.

Vague Pains and Flying Neuralgias.—The so-called "growing pains" in the young are probably of this class; the force in the system is insufficient to maintain growth without suffering a degree of impoverishment which expresses itself by a subdued growl of pain.

Waving, beating, rolling sensations are often felt by the neurasthenic, even when not exactly hysterical. Shooting neuralgic pains in the limbs, or nearly all parts of the body, cause much suffering with this class of patients. Sometimes flying neuralgias are confounded with the neuralgia of incipient locomotor ataxia, which they in some respects resemble, but are not as violent, and do not have so much of the boring character.

Flushing and Fidgetiness.—Patients of this class oftentimes easily flush and easily faint; the inhibitory action of the sympathetic is readily interfered with by any slight emotion. Fidgetiness and nervousness, inability to keep still—a sensation that amounts to pain—is sometimes unspeakably distressing. Although it cannot be defined, it may be an accompaniment of growing pains, and is one of the myriad results of spinal irritation. Sometimes in writing, the hand and arm become so nervous and fidgety that to continue writing would be the severest torture. When the legs feel this way, the sufferer must up and walk, or run even, though he be debilitated and is made worse by severe exercise. A gentleman once under my care could not sit still in the chair long enough to take an application of electricity.

Tremulous and Variable Pulse and Occasional Palpitations.—In the nervous, the rapidity and quality of the pulse beats may vary in many ways during the process of counting. Frequently the pulse of the nervously exhausted is compressible, and almost always it is more rapid than normal, ranging between 75 and 90, frequently going up to 95 and 100 and more. In exceptional instances nervous exhaustion has a very slow pulse, in the neighborhood of 40 or less.

Sudden Giving Way of General or Special Functions.—The treacherousness of nervous exhaustion is one of its most constant characteristics; its symptoms lurk in ambush and burst upon us when least looked for, when we fancy ourselves utterly and forever delivered from their presence. The neurasthenic patient cannot, therefore, trust himself a half hour or even a moment in advance. In the morning, he may be, or feel, able to walk five miles; in the afternoon, from no traceable cause, it may be a task to cross the street. Even in the midst of any labor—mental or muscular—his strength gives out as suddenly as if he were struck by lightning. I knew a man prostrated for two years with profound neurasthenia, who, if he rose and crossed the room, might become absolutely aphonic. Two ladies have been under my care who could walk readily for perhaps a block or more, when instantly, and without warning, their legs would give way beneath them.

Special Idiosyncrasies in Regard to Food, Medicine and External Irritants.—When the nervous system becomes exhausted it is apt to develop various idiosyncrasies not before observed; some of them are of high interest. Opium, for example, is likely to aggravate insomnia in many neurasthenic patients, instead of putting them asleep, unless, indeed, very large doses are used. Formerly opium was our chief, almost our only dependence when we wished to put one asleep. Now we scarcely think of using it for that purpose in the treatment of the nervous, except when there is

* Dr. Austin Flint, Sr., in his "Practice of Medicine," has a very short chapter on "Nervous Asthenia;" and my own paper was substantially republished in London, in Dr. Hugh Campbell's work on "Nervous Exhaustion," with but little additional matter. Dr. Weir Mitchell, of Philadelphia, has recently published a clinical lecture on the subject. Dr. J. S. Jewell, of Chicago, has also discussed the subject suggestively, though not systematically, in able review articles, and in a contribution to the American series of Clinical Lectures.

severe pain to be relieved. Opium for the nervously exhausted prevents sleep almost as much as coffee. So frequent is this idiosyncrasy, that were it not for the bromides and cannabis indica and electricity, we would be utterly disarmed in the presence of these cases.

In regard to alcohol, some are so susceptible that a drop of any form of liquor is instantly and injuriously felt in some part of the system. Others, on the other hand, lose all unpleasant susceptibility to alcohol and can bear it in incredible quantities, and may sometimes be profited by it. A lady whom I know had for years been passing through a series of symptoms of nervous depression that our most honored experts had failed to relieve. One day an ignorant and, I believe, irregular practitioner came into her house, and, without inquiring into her case at all, told her in a rough and authoritative manner to get the best of claret and drink it freely. The chance shot, sent in the dark and without aim, struck the very center of the bull's eye; the lady bought the best of claret, drank it with astonishing freedom, and found that it did for her what the best expert skill of our city had failed to do.

Coffee often acts badly with these cases. The other day a young man, who consulted me for sexual exhaustion with nervous dyspepsia, told me if he drank a single cup of coffee in the morning he was unable to attend to his business with comfort, and could not calculate or write correctly.

Incidentally, I will remark that *the development of idiosyncrasies, through nervous sensitiveness, acquired or inherited, is the real philosophy of hay fever*—a malady which, as I have shown in my work on that subject, has increased as culture and civilization have increased, and which is found usually in those who have had some other nervous symptoms. As an effect of this inherited or acquired nervo-sensitiveness, there appears in one person an idiosyncrasy against bright sunlight, so that exposure to it brings on the symptoms of hay fever; in another, a similar idiosyncrasy as to dust—the most common of all the excitants of this disease; in another, against fresh hay; in another, against ipecac or other drugs; in another, against old hay; in another, against the odor of roses, or other flowers; in another, against the pollen of corn, or of some of the grasses, or of certain weeds or Roman wormwood, or golden rod; in another, against some one of the common fruits—as grapes, apples, pears or peaches, or strawberries, or raspberries, or watermelons; and so on infinitely—new developments appearing every year. On this theory I based the nerve treatment of hay fever, and predicted that by means of electricity, strychnine, arsenic and other sedative and tonic remedies we should be able to greatly relieve and break up this distressing disorder. Last year this prediction was fulfilled not only in my own practice, but also in that of other physicians.*

Another idiosyncrasy developed by nervous exhaustion is *sensitiveness to cold or hot water.* A patient of mine could never bear to even dip his hands in hot water, so disagreeable were the sensations it produced; the same patient was abnormally ticklish and timid.

Dr. Harris, in a recent article on functional nervous troubles,† relates a case of a man of middle life, who, on getting up in the morning, would feel entirely well; but as soon as he had washed and wiped his hands they would begin to burn, tingle and ache very much, as when brought near the fire after exposure to snow. After a few seconds they would begin to swell, and would continue to swell for five or ten minutes to such a degree that he could not close or use them. In the course of an hour or more the swelling would go down, but would recur whenever he rubbed his hands. The phenomena disappeared in a week without treatment.

Sensitiveness to Changes in the Weather is a very often observed symptom of nervous debility; depression of the nerves makes the body a good barometer. For twenty-four hours and more before a storm comes on, the aching and worn nerves foretell in every part of the physical organism what is coming. The sky may be clear, but the spirits are cloudy. The tenderness of bunions and corns, the aching and stiffness of rheumatic and neuralgic sufferers, the general gloominess and misery of the exhausted before and during bad weather are not imaginations, but realities as truly as small-pox or the measles, and quite as much worthy of professional study and consideration.

Patients of this class are oftentimes made profoundly worse by the depressing atmosphere of dog days, and generally by the extreme heat of our summers. The latter half of August is especially severe on these cases.

A Feeling of Profound Exhaustion Unaccompanied by Positive Pain.—Attacks of a sensation of absolute exhaustion, as though the body had not strength to hold together, comes on very often in the nervously exhausted. This feeling of exhaustion, though not exactly pain in the usual sense of the word, is yet in many cases far worse than pain. These attacks may come on suddenly without warning, and may suddenly disappear. In the morning one may be able, or feel able, to run on a wager; in the afternoon of the same day sitting quietly in a chair seems to be an exhausting effort to which every nerve and bone and muscle is unequal. The *going-to-die* feeling is quite common in these cases, and at first causes alarm. It may be experienced either in the day or at night, on going to sleep, or on awaking from sleep. This symptom, like many of these symptoms, appears at puberty and at the change of life; it indicates that the system is straining under the burden placed upon it.

Ticklishness.—Nearly all persons are susceptible to the form of irritation that we call tickling; but in nervous exhaustion this susceptibility may become a severe annoyance. A gentleman once under my treatment for many of the symptoms described in this paper—spinal irritation being prominent—was so ticklish on the breast, stomach and abdomen, that it was very difficult—indeed, quite impossible—to apply electricity to those parts with any satisfaction.

Desire for Stimulants and Narcotics.—When the nervous system loses, through any cause, much of its nervous force, so that it cannot stand upright with ease and comfort, it leans on the nearest and most convenient artificial support that is capable of temporarily propping up the enfeebled frame. Anything that gives ease, sedation, oblivion, such as chloral, chloroform, opium or alcohol, may be resorted to at first as an incident, and finally as a habit. Such is the philosophy of many cases of opium or alcohol inebriety. Not only for the relief of pain, but for the relief of exhaustion, deeper and more distressing than pain, do both men and women resort to the drug shop. I count this as one of the great causes of the recent increase of opium and alcohol inebriety among women. Frequently an inherited tendency to inebriety is utterly latent, and does not break out until affliction, or some form of worry or distress, robs the brain of its nerve force. Very many cases illustrative of this have been published by my friend, Dr. T. D. Crothers, now superintendent of the Walnut Hill Asylum for Inebriates, Hartford, Conn.

Insomnia.—The wakefulness of the nervous is a symptom at once common and distressing, and is sometimes rebellious to all our bromides, and even to chloral. Sometimes it is the very first symptom of nervous disturbance, expressive of a mild phase of difficulty, and disappearing as the disease gets worse. In other cases it is constant and obstinate from first to last. This symptom may yield to electricity when other medication has no power.

Nervous Dyspepsia (Dyspepsie Asthénique).—It is one of the pecularities of nervous dyspepsia that it abhors a vacuum; is always much worse when the stomach is nearly or quite empty. Patients so afflicted need to take light meals, and to take them frequently—perhaps very many times daily.

In cases—not a few—nervous dyspepsia is the first noticeable symptom of nervous exhaustion—the earliest sign that the body is giving way; and for years the stomach may be functionally disordered before the brain or spinal cord or other parts or organs show signs of yielding; hence the quite common belief that dyspepsia leads to softening of the brain. The true philosophy is that nervous dyspepsia is a symptom of the same general pathological condition as all the orders of symptoms here noted, and it may follow as well as lead this multitudinous army. A literary gentleman whom I once met gave a history of nervous exhaustion from over-confinement, that after some years broke out through the pneumogastric nerve, causing profound and obstinate dyspepsia that for a long time made him a complete invalid; the symptoms were almost as bad as those of cancer of the stomach, and yet the disturbance was entirely functional, and the patient improved. Flatulence, with annoying rumbling in the bowels, these patients complain of very frequently; also nausea and diarrhea.

Partial Failure of Memory.—Memory is a measure of mind. When rightly studied it is perhaps the most delicate of all neurometers or indicators of the nervous force in health and in disease. With the growth of the brain in childhood memory grows, and it declines with the slow decay of normal old age. Partial failure or treacherousness of memory is not only a sign, but in some cases one of the very first signs of exhaustion of the nervous system. Business men find that they cannot depend on their memories as formerly; they forget details of engagements—sometimes those of importance—and thus are variously inconvenienced.

Sexual Exhaustion, or that form of nervous exhaustion that is noticed in young men who over-excite or over-use the genital function, in the natural or unnatural way, is usually, if not always, accompanied by failure of memory; but other forms of nervous exhaustion in both sexes offer the same symptom.

Deficient Mental Control.—Inability to concentrate the intellect on any task, as in writing or thinking, is a notable symptom. The mind wanders away in every direction, and when brought back by an effort of the will is liable to be soon again lost in revery.

In some cases the exercise of concentration, or even slight attention, is exceedingly irksome and painful, causing distress sometimes in the head, sometimes in the back or extremities, or other parts of the body.

Seminal Emissions—Partial or Complete Impotence.—Occasional seminal emissions in the healthy and unmarried are physiological—that is, they are not symptoms of disease, but normal and necessary results of abstaining from sexual intercourse. Such involuntary discharges, when excessively frequent, are both results and causes of disease, indicating an abnormal, usually an exhausted state of the nervous system, and in turn reacting on the nervous system, increasing the very exhaustion that causes it. Such, in general, is the philosophy of all, or nearly all, cases of frequent involuntary seminal emissions.

An attack of *acute* disease of any kind may leave the system, during convalescence, in a state where seminal discharges may take place with far greater than the normal frequency; on return to health this symptom, with all other symptoms of debility, disappears.

Chronic neurasthenia is often accompanied, as one of its symptoms, by seminal emissions, even in those who are married; indeed, some of the most persistent cases I have seen have been in married men.

Impotence—partial or absolute—when it appears as an effect of neurasthenia, as it frequently does, usually recovers with the improvement in the nerves, sometimes without special treatment.

Changes in the Expression of the Eyes and Countenance.—In sexual exhaustion downcastness of the features, aversion of the eyes and general sleeplessness of manner, with dark circles beneath the eyes, are symptoms that have long been observed, but these signs, taken individually, are not pathognomonic of any special form of nervous exhaustion, since they appear in nervous and digestive debility, however caused. It is, however, undeniable that these symptoms, in their entirety, do occur very frequently in the debility associated with sexual disorder, and may, perhaps, be set down as distinctive of that form of nerve disorder.

The mere expression of the eye is modified by disease in a way that it is hard to analyze or describe. How a night's debauch affects the expression is well known. In chronic nervous exhaustion from any cause or combination of causes, this expression of debility may become chronic—a permanent state that is revealed at once on meeting and addressing the sufferer.

A lady whom I once treated for numerous nerve difficulties, and who entirely recovered, told me that as she got better the whites of her eyes were of a clearer blue, and consequently, to her delight, more attractive. This fact was observed by several of her friends as well as myself.

(To be continued.)

* Hay fever regularly decreases as we go South. In the Gulf States it is comparatively rare, although it is found here and there in every State. In this respect also it follows the analogy of other nervous diseases to which it is allied.

† *St. Louis Medical and Surgical Journal*, April, 1878. Dr. Harris assumes that many of the cases that he relates are of exclusively malarial origin, and that such symptoms are only seen in malarial regions. In this supposition he is quite in error.

A THREATENED DEARTH OF SUBJECTS FOR DISSECTION.

THE editors of the *Hospital Gazette*, writing of "Dram Shops," indulge in the following slightly ironical remarks, which are worthy the attention of those who imbibe too freely:

Our profession and medical science generally has another interest in this matter, and one of which we hesitate to speak, because in this case our interest is greatly in the continuance of the free sale of liquors. If Dr. Crosby succeeds—as it now seems that he will, since Recorder Hackett has put his shoulder to the wheel—if he shuts up the dram shops, there will be a sad diminution of the supply of accidents and of diseases in the hospitals for clinical instruction, and of "material" for dissection. Indeed we do not believe there would be one hospital patient in the free hospitals where there are now ten, or that there would be one subject for dissection "unclaimed" where there are now twenty; we are not certain that there would be any. What in that event would our five or six medical colleges do? This is a serious question, and it might be well for the colleges and our profession to find an answer before the shops are shut up and the evil consummated.

Dr. Crosby, Recorder Hackett and the Apostle Mundy will be held responsible if these results come of their labors and their enforcement of laws. They will be regarded as men who obstruct the progress of science. No more unclaimed dead bodies, and no more "cases of interest" for the medical students who gather annually in this great metropolis, where crime and disease have hitherto been fed and nourished, and, when fully matured, have been shut up and exhibited for the instruction and entertainment of men of science.

Our readers will pardon us for having fallen into a line of reflection so unpleasant; but that the sources of supply will fail to our colleges if the dram shops are closed, is as certain as that the sun will rise to-morrow, and we are not likely to remain in doubt as to who did this thing.

GALLIUM AND ALUMINIUM ALLOYS.

By LECOQ DE BOISBAUDRAN.

LATELY I have been engaged in preparing alloys of gallium with several metals; I shall have the honor of laying them before the Academy as soon as I have completed my investigations into their properties. At present I confine my remarks to the alloys of gallium and aluminium to which my attention has been first directed.

When the proportion of aluminium has to be considerable, the two metals are heated at temperatures which do not exceed a dull red. Alloys thus obtained remain brilliant, and take up no particularly noticeable amount of oxygen during their preparation. On cooling they are solid, but brittle and non-resistant, even when the proportion of aluminium is sufficient to carry the melting point up to a dull red. They decompose cold water, and still better water at 40° C.; the decomposition being accompanied with an increase in temperature, the disengagement of hydrogen, and the formation of a chocolate-brown powder, which is finally resolved into white flakes of alumina. Almost the whole amount of gallium is liberated in the form of globules, which seem to be entirely destitute of aluminium. These alloys most frequently decompose water in the same way as an amalgam which contains a moderate amount of sodium, but for certain preparations the briskness of the decomposition can only be compared with that effected by sodium itself. The *slow* disengagement of hydrogen effected by a solid alloy is accelerated very much by the contact of a globule of liquid gallium. It is tolerably safe to assume the creation of an electric couple, the aluminium of which is the oxidizable metal.

Superfused gallium melts aluminium, even below 15° C., giving rise to liquid or pasty alloys of a high luster, little acted on by the oxygen of the atmosphere, and possessing in a high degree the property of decomposing water. The brisk decomposition of water brought about by the cold-made liquid alloy seems to need a certain initiation; no doubt a first electric couple must be set up. In the ordinary way this condition is realized spontaneously; but it has occurred to me before now to throw a globule of alloy into water without effect. A second globule, if taken from the same mass of matter as the first, was immediately attacked, and as soon as it touched the first, this was at once made active.

Cold-made liquid alloy gives, on contact with a trace of solid gallium, alloys which have the appearance of gallium and do not effect any sensible decomposition of water. The alloy remaining over from the crystals when these have been separated out seems to have lost a part of its power to act on the water. If the whole is remelted at the heat of the hand, the alloy is found to have regained its former susceptibility.

These properties recall the observations which have been made on alloys by several men of science. I may cite (1) the amalgams of aluminium, iron, nickel and cobalt, and the alloys of platina and lead, studied to so good effect by M. Cailletet, M. Damour, and MM. H. Sainte-Claire Deville and Debray; and (2) the physical investigations of M. Jules Regnauld, who has shown that amalgams of zinc and cadmium possess in the battery electromotor powers which depend on the quantity of heat absorbed or disengaged during the amalgamation of metals. In this regard gallium has properties in common with mercury and lead.—*Comptes Rendus.*

FORMATION OF METALLIC ARSENIDES.

By A. DESCAMPS.

ON attempting to prepare metallic arsenides by submitting arsenites or arseniates to the reducing action of hydrogen, carbonic oxide, or coal gas, the author obtained very imperfect results. He also reduced arseniates in a crucible with potassium cyanide in excess, so as to form a liquid layer which might preserve the compound from the action of the atmosphere. In these experiments he continued the application of heat till arsenical vapors no longer escaped. With many metals, however, arsenic does not form absolutely definite compounds, but alloys, which, after being heated for a certain time, may lose arsenic and change their composition. He has also prepared arsenides by the direct action of metallic arsenic upon the metal in a current of hydrogen, or, preferably, by heating the metal in a crucible along with excess of arsenic and borax as a flux. The arsenides of copper, gold, and silver have been prepared by placing metallic arsenic in solutions of copper sulphate, silver sulphate, or gold chloride.

RESEARCHES ON THE ACTION OF DRIED OXALIC ACID UPON THE PRIMARY, SECONDARY, AND TERTIARY ALCOHOLS.—MM. CAHOURS and DEMARCAY.—The action of dry oxalic acid upon the tertiary alcohols, which consists in resolving them into hydrocarbides and into water which combines with the oxalic acid, establishes a very well-defined distinction between these compounds and the primary and secondary alcohols, both the latter being under similar circumstances transformed into oxalates. Similar results might doubtless be obtained by causing dry oxalic acid to act upon the so-called pseudo-alcohols.

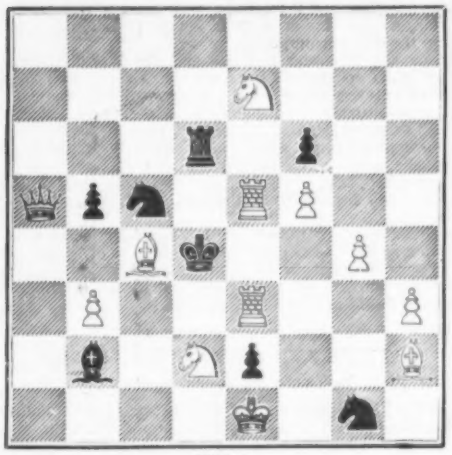
SCIENTIFIC AMERICAN CHESS RECORD.

[All contributions intended for this department may be addressed to SAMUEL LOYD, Elizabeth, N. J.]

PROBLEM No. 102.—BY M. LEPRETTEL, Marseilles, France.

"Honneur et Patrie."—Lebanon *Herald* Tourney, 1878.

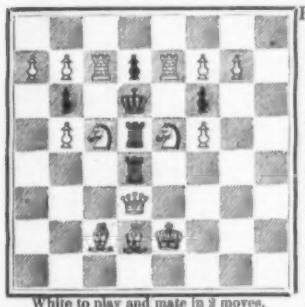
Black.



White.

White to play and mate in two moves.

E. S. BREWSTER, OF SPRINGFIELD, MASS.



White to play and mate in 2 moves.
"The Challenge Cup," by S. LOYD.

THE subject of our present sketch was well known many years ago as a most skillful player and promising composer. He was the strongest player of Amherst College, at a time when chess was greatly encouraged by that institution, and with Mr. J. A. Fay, Jr., was selected to play the memorable match between the Amherst and Cambridge Colleges in 1859, which resulted in a brilliant victory for the former.

Mr. Brewster died shortly after this match, and the chess world lost a brilliant genius who would undoubtedly have made his mark in the world.

He composed in all about forty problems, which are remarkable for their originality and purity. The one we gave in SUPPLEMENT No. 92, which won the post of honor in the *Clipper* Tournament, is a capital specimen of his skill. As few of our chess readers ever met Mr. Brewster, the portrait which we have secured will be appreciated by those who have admired his compositions.

THE AMERICAN CHESS CHAMPIONSHIP.

FROM the last number of the *Chess Journal* we extract the following, which is being copied extensively by the leading chess editors, who give it their hearty indorsement:

"Believing that it behooves the promoters of the organization and its members to carry out its original intentions, we propose the following programme for an annual Challenge Cup Tournament, which we present for the consideration of the members of the Association, and request that all who are in favor of its adoption, or have further suggestions to offer, will so report to the Secretary, Mr. J. B. McKim, Cleveland, O., as we are determined to have a grand tournament and jollification upon the return of the American team.

"It is suggested that the American Chess and Problem Association furnish a challenge trophy that shall represent the American championship, and be held by the winner subject to a challenge from all players.

"Of course there must first be a grand tournament to decide who shall be the first holder of the championship, and we would suggest that the place of meeting be determined by a vote of the members, or depend upon which club will make the most liberal offer for the privilege of having the contest take place in their city.

"1. The challenging party at the time of serving a challenge must hand the champion (or an officer of the Association) a written notice accompanied by five dollars, which is given to the champion in lieu of other stakes to reimburse him for his time; the challenging party must also send a copy of his challenge to one of the officers of the Association (either President, Vice-President, Secretary, or Treasurer), which must be accompanied by a further payment of five dollars, which is added to the funds of the Association. The battle ground for a champion match can only be changed by mutual consent, as the champion has the right to insist on its being played at the chess rooms of the club in the city in which he resides.

"A player who comes from some other city and wins the championship is subject to receive a challenge to play at the same locality where he won it, and may be there repeatedly challenged by any players complying with the terms as previously stated; but in case one week should pass without a challenge being served upon the champion or any officers of the Association, then the champion who has won the championship can remove the battle ground to the city in which he resides.

"2. Any player winning the championship must at once notify the officers of the Association, and furnish a record of the match and his address, and must also file with one of the said officers a week's notice of a contemplated change of the battle ground.

"The trophy will consist of a suitable work of art, either in gold or silver, which will be given into the care of the champion, who must be responsible for its safe return or transfer to a winner.

"On the —— day of ——, in each year, whoever holds the championship shall receive from the Treasurer of the Association 30 per cent. of the playing funds of the Association, and shall continue to receive them so long as he conforms to the rules of the Association and holds the championship."

This plan is meeting with the hearty approval of our chess players, and will undoubtedly be carried into effect. Subscriptions—or rather donations—have been received from upward of a score of our leading players. As it is proposed to make it a national affair, we therefore invite and urge every chess player in the United States to give the matter his personal indorsement by making a slight contribution of at least one dime, which they may send with their name and address to the Treasurer, Dr. C. C. Moore, 68 and 70 Cortlandt St., New York.

A grand tournament will undoubtedly be arranged to celebrate the return of our American players from Paris.

ASSOCIATION LETTER TOURNAMENT OF 1878.

THIS tournament was inaugurated through the columns of the SCIENTIFIC AMERICAN SUPPLEMENT, by Dr. C. C. Moore, who offered the amount of some problem prizes he had received ($30) as a letter prize; Mr. Loyd added two extra prizes (bound volumes of the SUPPLEMENT and *Journal*, two of each) as second and third prizes. As our composers were remarkably backward in coming forward, the projectors themselves were induced to enter the lists to wake up our problemists; at the last moment a few of our composers realized the fact that a handsome prize was going begging, and a few hurried problems were received, making in all a competition of ten problems.

In the first Centennial Letter Tournament it will be remembered that Mr. Loyd received the first prize for his letter "R." It was suggested then that the letters be arranged and published so as to spell the name of the winner. A short time since the Doctor, who has the matter in charge, found that there was a D wanting to spell the name of the winner, and invited Mr. Loyd to contribute one to this tournament to supply the deficiency, which he did, little thinking, however, that the verdict of last year would be duplicated so completely as to again add the letter prize to his share of the spoils.

E. S. BREWSTER, OF SPRINGFIELD, MASS.

The first prize is awarded to Samuel Loyd for the letter D.

Second prize to A. Finch, Jr., for the letter P.

Third prize to Dr. C. C. Moore for letter H.

The following is the letter from the umpire:

NEW YORK, June 25, 1878.

DEAR SIR:—In compliance with the request that I should adjudicate upon the rival claims of the ten consonants contributed to the Letter Tourney inaugurated under your auspices, I have subjected each to a careful examination, and am of the opinion that the problem representing the letter D is entitled to the foremost position. Despite a few *possible* duals, it is an excellent and ingenious composition, and presents a very successful embodiment of a theme which would have been highly creditable in a position unfettered by the restriction of the author's chosen device. The remaining candidates I would rank in the following order of merit, viz.: P, H, L, G, D, V, R, J and B—the C having collapsed under the weight of an intrusive solution.

Respectfully,

CHAS. A. GILBERG.

TO DR. C. C. MOORE.

VALEDICTORY.

WITH the present issue we complete the record of American Problem Tournaments up to date, and at the same time conclude our year's engagement to furnish the chess department of the SUPPLEMENT. In closing our most agreeable connection with the paper, we beg leave to mention to our chess friends that while we have in every way endeavored to compile the most complete Chess Record and encyclopedia that has ever been attempted, the enterprise has been met in the most liberal manner by the publishers, who have preserved plates of the chess department and will shortly issue the same in handsome book form, carefully indexed, with such typographical errors corrected as have accidentally crept into the department.

Trusting that the enterprise will meet with a liberal response from the chess fraternity.

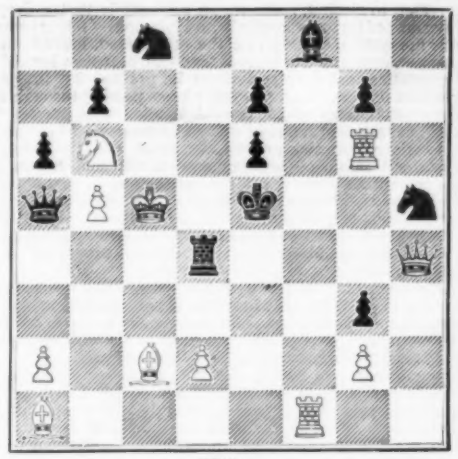
I remain respectfully,

SAMUEL LOYD.

PROBLEM No. 103.—BY M. LEPRETTEL, Marseilles, France.

"Honneur et Patrie."—Lebanon *Herald* Tourney, 1878.

Black.



White.

White to play and self-mate in two moves.

SOLUTIONS TO PROBLEMS.

No. 98.—BY CONRAD BAYER.

WHITE.	BLACK.
1. Q to Q Kt 3	1. Kt to Q 5
2. Kt to K 7 ch	2. B x Kt
3. B to R 4 ch	3. K x B
4. Q to K B 3 mate.	

No. 99.—BY HERR KLING.

WHITE.	BLACK.
1. K to Kt 8	1. B to B 6
2. Q to B 2	2. P to R 7
3. Q x P	3. B to K 8
4. Q to R 7 mate.	

LETTER "I."—BY S. LOYD.

WHITE.	BLACK.
1. Kt x P (dis ch)	1. K x Kt
2. Q to R or Kt 5 ch	2. K moves
3. Kt checks	3. K moves
4. Q mates.	

No. 100.—BY SAMUEL LOYD.

WHITE.	BLACK.
1. Q to K R sq	1. K to Q 4 (dis ch)
2. R to K 6	2. Any move
3. Mates.	

No. 101.—BY SAMUEL LOYD.

WHITE.	BLACK.
1. B to Q Kt 5	1. P x B
2. Q to K B sq	2. K x P
3. Q to B 6 ch	3. K moves
4. Q mates.	

LETTER "C."—BY W. A. KANE.

WHITE.	BLACK.
1. P knights ch	1. K to K 3
2. Q to K 4 mate.	

No. 88.—BY CARPENTER OR SHINKMAN.

WHITE.	BLACK.
1. B to Q R 4	1. Any move
2. Mate follows.	

No. 102.—BY M. LEPRETTEL.

WHITE.	BLACK.
1. R to K Kt 3	1. Any move
2. Mates.	

No. 103.—BY M. LEPRETTEL.

WHITE.	BLACK.
1. Q x K P	1. Any move
2. White checks so as to compel black to give mate.	

LEBANON HERALD TOURNAMENT NO. 2.

THIS tournament was inaugurated immediately after the close of the first famous contest, which met with such an unprecedented success, and like its predecessor was limited to compositions of two moves, one a direct mate, the other a *suicide*.

Two handsome prizes were offered, which Mr. Joseph N. Babson, the distinguished Boston problemist, in capacity of umpire, has just awarded to M. Leprettel, of France, and second prize to W. A. Shinkman, of Grand Rapids, Mich.

We regret that the problems have not all been published, so that we can give a further selection, but while congratulating M. Leprettel upon carrying off the highest honors, we feel a special satisfaction in finding that Mr. Shinkman, who received the honors of the first tournament, has again come so prominently to the front and rebuked his impertinent critics of last year.

A WORK ON PROBLEM COMPOSING.

FINDING that among the thousand and one chess publications there is not a single book upon this popular branch of the game, Mr. Loyd is preparing to issue a work upon chess problems illustrated by five hundred of his best compositions. The price will be $2.50. As it will be issued by subscription, those who desire the same address S. Loyd, Elizabeth, N. J.